Power and heat transformation policy:

Actor influence on the development of the UK's heat strategy and the GB Renewable Heat Incentive with a comparative Dutch case study

Submitted by Richard James Lowes, to the University of Exeter as a thesis for the degree of Doctor of Philosophy in Geography, March 2019.

I certify that all material in this thesis which is not my own work has been identified and that no material has previously been submitted and approved for the award of a degree by this or any other University.

ABSTRACT

The system for space and water heating in the UK must be transformed if policy goals are to be met. This transformation will require major technological and social changes including the renovation of homes and other buildings, the replacement of any appliances which combust fossil fuels with low carbon heat technologies and infrastructure changes. An effective Government strategy will need to drive these changes through policies, regulations and the development of a clear vision. The UK Government has already made a number of policy interventions associated with decarbonising heating.

Transformations of large systems, such as the UK heat system, have been increasingly considered from the perspective of 'sustainability transitions', a branch of theory which considers the transitions of large socio-technical systems from being 'unsustainable' to 'sustainable'. The 'multi-level perspective' is a model which has emerged from the 'sustainability transitions' literature as potentially valuable. However, this model and wider approaches to 'sustainability transitions' have been accused of not paying enough attention to the complex social phenomenon of power. Greater insights around power and policy change associated with transitions could strengthen transitions theories by providing evidence of how power can affect socio-technical change.

Employing an approach to power called the 'four faces of power' and using a methodology called the 'EAR instrument' based on data triangulation which has never before been applied to UK energy policy issues, this inter-disciplinary research investigates the combined issues of power, transitions and the policies associated with UK's heat system. Power in this thesis is understood as the ability of actors to affect policy and governance associated with the decarbonisation of heat. Therefore an actor is considered powerful or to have had power if their behaviour has successfully affected policy change.

The thesis examines if actors have had the power to affect historic UK heat policy and what approaches have been used to attempt to influence it. In doing so, the research provides original contributions to the literature on UK energy

policy which has seen little focus on heat decarbonisation and similarly little focus on how politics and influence affect policy change. A Dutch case study has also been completed as the Netherlands has a similar, highly natural gas dependent heat system. Similarities and differences between the two countries have been investigated.

Numerous attempts to influence heat policy by various actors have been identified in both countries. Approaches used to have power over policy and the actors involved in attempts to have power have been considered in detail. Only some attempts to influence have been successful and contextual and institutional issues have also affected power struggles. The size of actor has not determined policy influencing success in this analysis.

The power associated with policy change is shown to be an important element of the UK's heat transformation. As actors primarily attempt to influence policy based on their own interests and appear to have some success, a major issue for transitions may be that the speed and direction of transitions reflect politically active actors' interests, rather than wider societal interests. However, in this study, actor power has operated to both constrain and emancipate the transformation showing that power is not, in this example, one directional.

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DEFINITIONS AND ABBREVIATIONS

ADBA – Anaerobic Digestion and Bioresources Association

ADE – Association for Decentralised Energy

ASHP – Air source heat pump

BEIS – Department for Business, Energy and Industrial Strategy

CCC – Committee on Climate Change

CHP – Combined heat and power

CHPA – Combined Heat and Power Association (now ADE)

DECC – Department of Energy and Climate Change

ECN – Energy Research Centre of the Netherlands

GSHP – Ground Source Heat Pump

HHIC – Heating and Hot Water Industry Council

IPPC - Intergovernmental Panel on Climate Change

LPG – Liquefied petroleum gas

MCS – Microgeneration Certification Scheme

NAO – National Audit Office

NGO – Non-governmental organisation

REA – Renewable Energy Association

RHI – Renewable Heat Incentive

RHPP – Renewable Heat Premium Payment

SDE – Stimulering Duurzame Energie (Stimulating Sustainable Energy)

SEA – Sustainable Energy Association

STS – Socio-technical system

UKERC – UK Energy Research Centre

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1 INTRODUCTION

Heat is a vital part of every life. It provides health benefits protecting people from the external elements; it delivers hygiene through washing and cleaning; it cooks food enhancing flavours, increasing nutritional value and killing harmful bacteria and it can also provide a great deal of thermal comfort. However, the current greenhouse gas emissions associated with heat production and use at a global level must be reduced to mitigate climate change, a key sustainability challenge.

Heat accounts for more than 50% of global energy consumption and is responsible for around a third of global carbon dioxide emissions (as a result of the burning of fossil fuels) (IEA, 2014). The Intergovernmental Panel on Climate Change (IPCC) suggests in its 2014 Fifth Assessment Report that a pathway which keeps global warming to below two degrees Celsius from pre-industrialised levels needs to see global greenhouse gas emissions reduced to around zero levels by 2100 (Edenhofer *et al.*, 2014). A major reduction in greenhouse gas emissions requires a major reduction in emissions from fossil fuel energy and therefore heating.

The target of limiting the global temperature rise to 1.5 degrees Celsius, as an aspiration in the 2015 Paris Agreement on climate change, requires global net zero emissions by 2050 (Sanderson *et al.*, 2016) therefore requiring even faster decarbonisation of energy (and heating) across the world.

This thesis is interested in the decarbonisation of heat in the United Kingdom, a country which uses fossil fuels for the vast majority of its heating needs. Currently 78% of heat consumed in the UK comes directly from fossil fuels and only around 7.7% of the UK's heat currently comes from lower emission renewable sources (BEIS, 2018c).

The UK needs to rapidly transform the way it produces and consumes heat in order to meet its own legal commitments under the UK's Climate Change Act to reduce emissions by 80% compared to 1990 levels (Parliament, 2008a). As a result of signing up to the Paris Agreement, the UK's greenhouse gas emissions reduction trajectory may need to be even steeper and the UK looks likely to need to reach net zero emissions levels during the second half of the century on

even a two degree pathway (Energy and Climate Intelligence Unit, 2017). Net zero implies no fossil fuels are combusted for heating without either some form of offsetting or emissions capture, clearly requiring transformative change for heating.

This thesis is specifically interested in the energy policy associated with attempts to decarbonise heat used in buildings for the purposes of space heating and the production of hot water[1] in the UK. Energy policy is taken to mean the Government rules, incentives, instruments, strategies and goals associated with energy – in this case heat energy. Energy policy is one element that can potentially drive change in energy systems and the rapid and deep decarbonisation needed for the UK's heating system means that policy may be very important.

The specific theoretical focus of the thesis considers ideas of 'power'. Power is a broad social and political concept interested in how people and groups of people such as organisations (both referred to as 'actors' throughout) can cause or slow change[2]. While a much more detailed investigation into the idea of power is taken in chapter 4 which highlights the complexity of the idea of power, power is defined in the context of this thesis as the ability of actors to affect policy and governance associated with the decarbonisation of heat.

The thesis is interested in how actors have attempted to influence UK heat policy, and their success or failure. Because policy is likely to be an important driver of the UK's potential heat transformation, if actors can influence policy, this could be important in shaping or perhaps constraining the UK's transformation to low carbon heating.

As well as being interested in power, policy and heat decarbonisation, this thesis situates itself in the field of 'sustainability transitions', an approach

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[1] Around 24% of the heat consumed in the UK is used by the industrial sector and 15% of total heat demand is used specifically for industrial processes (BEIS, 2018d). Because of the nature of industrial heat requirements, this heat demand is very different to space and hot water and so technologies and approaches for industrial heat are very different. In their work on incumbency, Lowes et al., (2018b) consider current industrial heat use and describe the Government sponsored industrial roadmaps for industrial decarbonisation released in 2015. There is notably very limited research into decarbonisation of industry in the UK and a complete absence of any recent industrial decarbonisation policy research.
[2] A much fuller description of ideas around power takes place in chapter 4.

interested in how and why the transformation of large systems, which include social and technological elements, take place. Specifically, the 'multi-level perspective' (MLP) approach is used as a framework to consider the UK heat sector; MLP is an approach which attempts to consider the entirety of large systems but which has previously been accused of not paying due attention to issues of power (see Smith *et al.*, (2010) and Geels, (2014)). This thesis provides a valuable case study for transitions scholars, investigating power associated with a live socio-technical (heat system) transition.

The empirical elements of this research consider UK heat policy between 2003 and 2015 (research interviews were carried out mainly during 2015). During this time period, two key developments took place, firstly the introduction of the Renewable Heat Incentive (RHI), a policy to deploy renewable and low-carbon heating in the UK and secondly the development of a long-term strategy/vision for decarbonised heat. The thesis considers:

- if and when actors have been successful in causing policy change;
- the actors involved;
- the approaches taken in attempting to cause change.

Particular approaches of interest are lobbying (i.e. purposive attempts by actors to attempt influence heat policy change) and framing (where actors shape their approaches to lobbying around particular ideas which may resonate with policy makers).

A short comparative case study also considers power and heat policy in the Netherlands, a country with a similar heat profile to the UK. Similarities and differences between policy power issues in the two countries are identified in order to consider if generalisations can be made.

While project research questions are formulated in the theoretical chapters of the thesis (3-6), the research questions are also placed here for reference:

1. How has UK heat generation policy been affected by the power of actors?
2. What approaches have been used by actors to attempt to affect UK heat policy?
3. Do ideas have power as frames in the heat policy process?

4. How can understandings of power which emerge from this research be used to strengthen the multi-level perspective on transitions?

1.1 STRUCTURE OF THE THESIS

Chapter 2 considers the UK's current heat system exploring the requirement for change, the potential pathways for low carbon heating and the policies which currently exist to drive the move to lower carbon heating.

Chapter 3 explores the concept of sustainability transformations, approaches which consider how large systems can change from being unsustainable to more sustainable. Particularly, it pays attention to the so-called multi-level perspective. This chapter also investigates how the concept of power has, and often hasn't, been considered in approaches to transitions.

Chapter 4 investigates the concept of power, considering key themes and developments in this social and political field. It highlights the key ideas of power used throughout the thesis, introducing the '4 faces of power' approach, the role of structural and agent-based power and ideas of 'transitive' and 'intransitive' power.

Chapter 5 considers the relationship between ideas of power, politics and policy; showing that the three are closely linked. The chapter also describes the frequent focus in the power/politics/policy literature on 'ideas', 'institutions' and 'interests' and expands on the elements of these approaches most relevant for this thesis.

Chapter 6 is the final chapter of the underpinning theory section and it pulls together elements from the previous three theoretical chapters to develop a framework for considering power in the context of policy which is looking to drive system transformations.

Chapter 7 outlines the methodological approach taken for data collection and analysis. The method is based on a case study approach which uses a combination of interviews and grey data analysis. A triangulation approach (where a number of sources are compared for accuracy) is used to investigate successes and failures at lobbying by actors and is also used to consider approaches to influence.

Chapter 8 is the first results section, outlining the key heat policy episodes between 2003 and 2015 where power has been seen to be an important element.

Chapter 9 describes the key actors who have been involved in power and the development of heat policy over the research time period.

Chapter 10 describes the approaches used to influence heat policy which were highlighted by the analysis.

Chapter 11 contains a comparative case study which considers power and heat policy in the Netherlands.

Chapter 12 contains the overall project conclusions and also includes an implications for policy section.

The annexes include information on associated research, outputs, impact and the role of the researcher (annex 1), information on interviews (annexes 2 and 3) and technical information on heat policy issues (annexes 4 and 5).

1.2 CHAPTER SUMMARY

This chapter has provided an introduction to the thesis and described the general structure. While this chapter has briefly considered the global context of the UK's heat system, the following chapter considers heating in the UK in much more detail and explains what the UK's own climate change mitigation goals may mean for heating in the UK.

2 THE UNITED KINGDOM HEAT REGIME

This chapter paints a picture of the current system for space and hot water heating in the UK[3], describing the types and quantities of different fuels used and the different sectors of heat demand. It explores how the current gas dominated system has developed and also considers the key issues with the existing system: import reliance and greenhouse gas emissions.

The chapter then considers the need for a transformation of the UK's heat system and outlines the potential technological pathways towards low carbon heating. Finally this chapter considers the previous and current policy approaches which have attempted to deploy low carbon heat in the UK.

2.1 HEAT USE IN THE UK

Heat use makes up 44% of total UK energy consumption (BEIS, 2018d). Of the 59,456 thousand tonnes of oil equivalent used for heat in 2017, the majority of heat is provided by natural gas with electricity and oil providing the next most significant shares (BEIS, 2018d). The split in fuels used for total heat use is shown in Figure 2-1.

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[3] In this thesis, if the term 'United Kingdom' is used, this includes Northern Ireland. If the term Great Britain is used, this means that Northern Ireland is not being considered. The key issue associated with this differentiation in this thesis is that the UK Government's work on the Heat Strategy considered the UK whereas the Renewable Heat Incentive which was developed by the UK Government only operates in GB. Northern Ireland has its own separate renewable heat support scheme which has been the subject of much media and political interest.
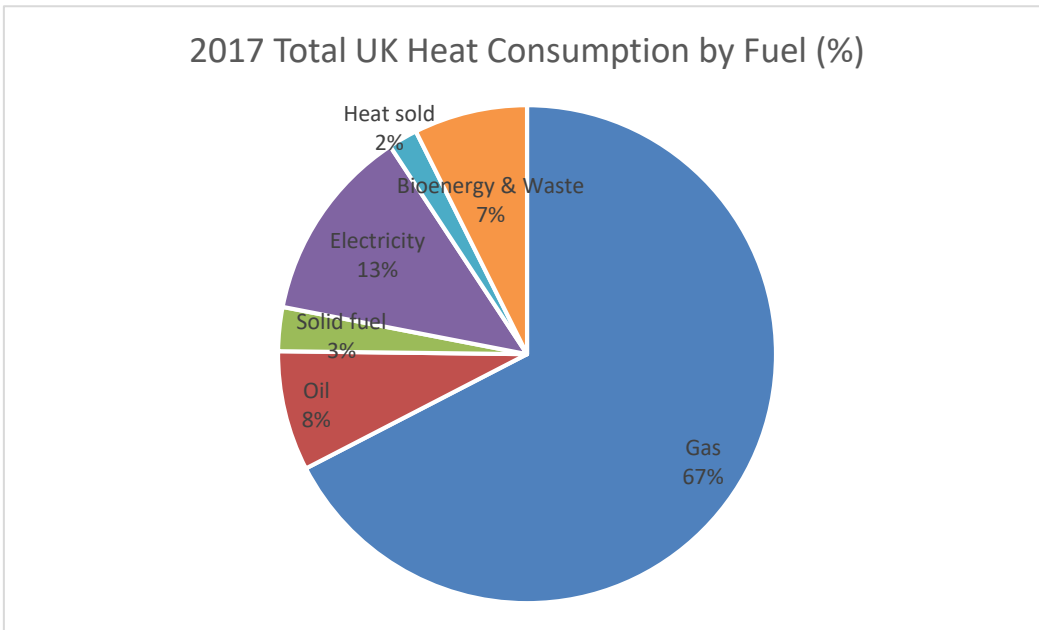
Figure 2-1. UK 2017 total heat consumption by fuel based of BEIS consumption data (BEIS, 2018d)

UK Government data splits heat consumption into three main sectors, domestic, service and industry. In 2017, 56% of all heat was consumed in the domestic sector, 20% in the service sector (including shops, offices, schools) and 24% in the industrial sector (BEIS, 2018d). Across these sectors, space heating is the largest element of heat consumption making up 63% of total heat consumption with the remaining 14% of heat being used for heating water and 15% used in industrial processes. Overall, space heating, water heating and cooking account for 82% of total heat demand (BEIS, 2018d).

Of the heat not used in industry, i.e. that for space and hot water heating and cooking, the majority of heat (69%) is provided using gas with electricity, oil and bioenergy responsible for around 10% each (BEIS, 2018d). The full split is shown in Figure 2-2. While the domestic and service sectors are relatively similar in the terms of the proportion of fuel types used for heating, one notable difference is that the service sector has a lower proportion of gas heating but higher proportions of electric and oil based heating compared to the domestic sector (BEIS, 2018d). Also worth noting is that heat for cooking in the UK is provided by an almost even split of gas and electricity (BEIS, 2018d).

UK 2017 Space Heating, Water Heating and Cooking
Consumption Split by Fuel (%)
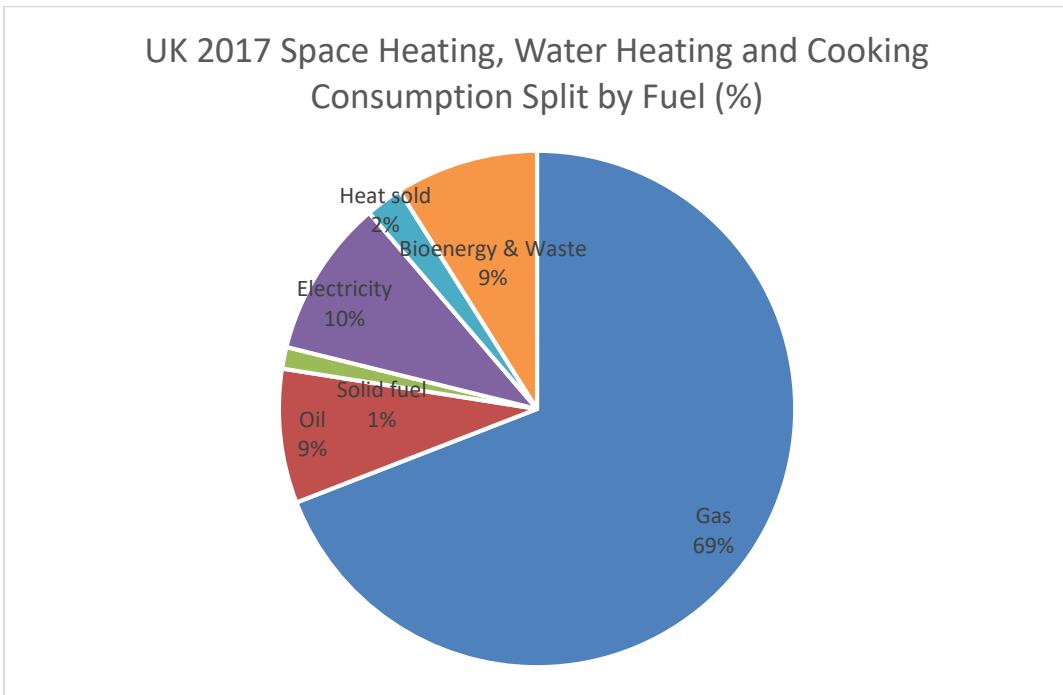
Figure 2-2. UK space heating, water heating and cooking consumption split by fuel based on BEIS data (BEIS, 2018d).

In practice, this all means that the majority of UK homes (84%) and businesses are connected to the gas distribution network; this is around 24 million connections in total (Xoserve, 2018). Those not connected to the gas network generally use oil for heating which is delivered by tanker or use electricity for heating either in night storage heaters or direct electric heaters. A very small amount of solid fuel (primarily coal) is used and 2% of heat (referred to as 'heat sold' in Figure 2-2) is provided via heat networks which distribute heat as hot water or steam. The 9% of heat which is produced using bioenergy and waste primarily comes from the combustion of wood in fires and stoves with some energy also from biogases (BEIS, 2018c).

The UK has one of the highest penetrations of gas heating in the world[4], beaten only by the Netherlands which has around 93% of households connected to their gas network (ECN *et al.*, 2016).

There are two key historical periods associated with the growth of gas for heating which have been explored in detail by Arapostathis et al., (2013). From the end of the eighteenth century to the mid twentieth century, gas use grew as private companies who operated local gas networks using town gas expanded

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[4] This has been inferred from an internet search.

their gas grids and moved beyond gas purely being used to provide lighting with gas increasingly also being used for cooking at heating. As shown in Figure 2-3, the number of gas customers grew rapidly between 1900 and 1930. The second period of rapid change followed the discovery of 'natural' gas in the North Sea. In the late 1960s, the Government started a national programme to connect the small networks together and convert the network and gas appliances to burn 'natural' gas from the North Sea. The conversion programme took around a decade and as can be seen in Figure 2-3, following the programme the number of gas customers grew rapidly as more customers were connected to the gas system as part of the Government's gas expansion programme.
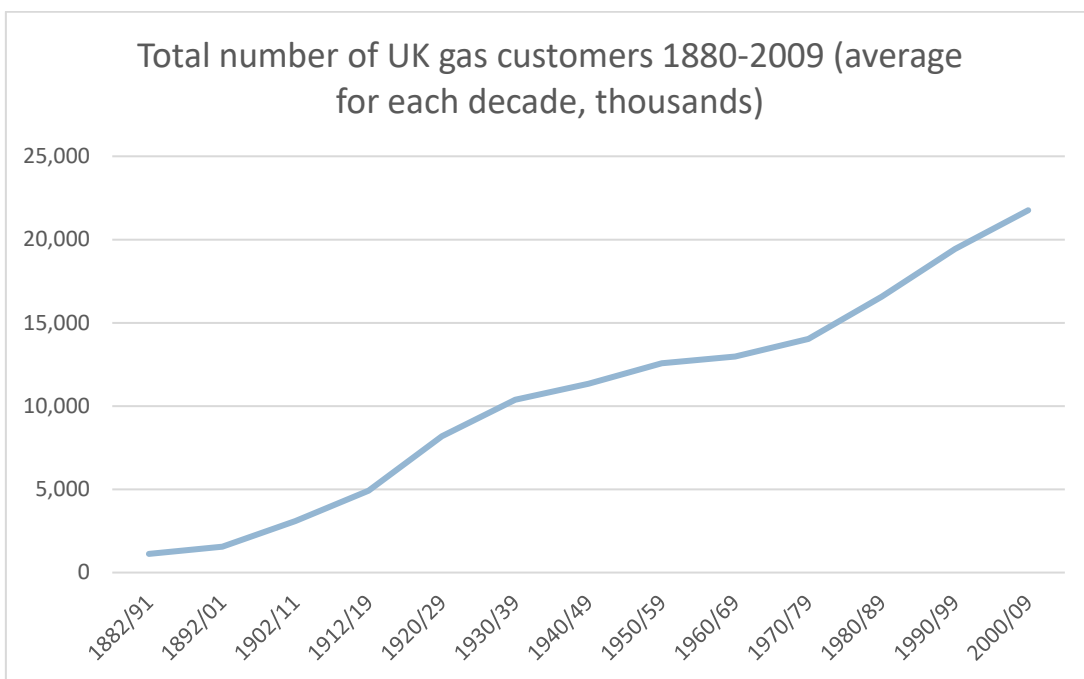
Figure 2-3 Total number of UK gas customers from 1990-2012. Based on data from BEIS, (2013)

For those UK customers who aren't connected to the gas grid, the type of heating used depends simply on what was installed when the building was first built or what it has been changed to since. New buildings near to a gas network do often connect to the gas grid although recent connection data is not publicly available. In 2014, the Energy Networks Association suggested that over 150,000 buildings connect to the gas grid each year in the UK (Energy Networks Association, 2014) which implies a slower level of growth than in the past few decades. This reduction may however have happened because housebuilding rates were significantly lower when the Energy Networks Association released their data than compared to the previous decades

(International Longevity Centre, 2014). Despite the fact that more homes are connecting to the gas grid each year, overall the total volume of gas used in UK homes has reduced between 2004 and 2017 by around 25% because the average household demand for gas has reduced (BEIS, 2018d). This reduction in domestic gas demand has been suggested to be as a result of various factors including increasing prices, energy efficiency improvements including those associated with new boilers and changes to household composition (BEIS, 2018g).

As described previously, significant growth of the UK gas system was driven as a result of discoveries of North Sea gas. However, much of the gas which was present in UK gas reserves has now been used and since 2001, the UK has been a net importer and currently imports around 50% of all gas demand; this import reliance is expected to increase as continental shelf gas fields become completely depleted (National Grid, 2018). With regards to gas supply security the UK Government stated recently: '*We are secure now, and the GB gas system is well placed to continue to be secure and robust in a range of supply and demand outcomes over the next two decades*' (BEIS, 2017a, p3). However, if the UK continues to import high levels of gas or increases levels of imports, high levels of import dependence could be a reason for concern in the future (Bradshaw, 2018).

2.2 THE GREENHOUSE GAS PROBLEM

As described in the previous section, much of the UK's heat consumption is met through the combustion of fossil fuels; these fuels all produce greenhouse gas emissions when they are burnt. Heat produced from electricity will also have associated emissions because fossil fuels are used to generate some electricity too[5]. Overall, the consumption of heat in the UK is responsible for 182 megatonnes of greenhouse gas emissions (CO_2 equivalent); meaning that heating is responsible for 32% of all UK greenhouse gas emissions (DECC,

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[5] In 2017, around 47% of the UK's electricity was produced from gas or coal; however the fossil fuel share in electricity has decreased as renewable electricity generation has increased (BEIS, 2018c)

2012a)[6]. 48% of these emissions come from domestic heat, 20% from service heat and 32% from industrial heat (DECC, 2012a).

If the world is to limit temperature rises caused by greenhouse gas emissions, emission reductions are needed. The UK's Climate Change Act mandates in law an 80% reduction in greenhouse gas emissions by 2050 compared to 1990 levels (Parliament, 2008a). This implies an annual UK carbon budget in 2050 of 165 megatonnes of greenhouse gas emissions (Committee on Climate Change, 2016b). The current emissions from heat are higher than the 2050 carbon budget suggesting that some emission reductions from heat will be required even if all non-heat emissions were eradicated. However, the Committee on Climate Change, who advise the UK government on climate mitigation and adaptation, suggest that nearly all emissions may need to be eradicated from space and hot water heating in order to meet the 2050 carbon budget. This is because there are other sectors that look extremely difficult/impossible to decarbonise completely; these are industry, agriculture and international aviation and shipping (Committee on Climate Change, 2016b). Other analysis considering heat in the UK has come to the same conclusion, that in order to meet the 80% emission reduction target, emissions from space and hot water heating need to be almost eradicated by 2050 (e.g UKERC, 2009, DECC, 2012, Committee on Climate Change, 2015).

While the UK's current 2050 greenhouse gas reduction target may allow some residual emissions, as explained previously, it is generally assumed that space and hot water heating will need to be fully decarbonised. However, the Paris Agreement on climate change of which the United Kingdom is a signatory aims to hold '*the increase in the global average temperature to well below 2°C above pre-industrial levels' and to pursue 'efforts to limit the temperature increase to 1.5°C above pre-industrial levels*' (UNFCCC, 2015). The 1.5°C target would require global greenhouse gas emissions to reach net zero emission levels by

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[6] This is the most recent data available as these statistics have not been published since. In light of the limited recent change in the UK heat sector, it is unlikely that the total emissions will have changed. However, as noted in UK emissions statistics, as there have been significant reductions in the emissions associated with electricity generation, it is likely that the proportion of the UK's emissions from heat as a percentage has increased. The CCC note that for the past two years, temperature adjusted emissions from buildings have increased (Committee on Climate Change, 2018a)

2050 (Sanderson *et al.*, 2016). The UK Government has asked the UK Committee on Climate Change to consider what the Paris agreement may mean for the UK's existing carbon reduction target following the release of the Intergovernmental Panel on Climate Change's report into a 1.5°C scenario (Committee on Climate Change, 2018b). Previously in 2016, the UK Government explained that '*The Government believe we will need to take the step of enshrining the Paris goal of net zero emissions in UK law*' (Parliament, 2016).

It therefore seems likely that the UK will at some point introduce a net zero emissions target although when this may happen and when the target date would be is not known. The expectation of a net-zero emissions target therefore means that the requirement for the eventual total decarbonisation of heating is now more likely than under the UK's existing 80% reduction target.

By taking ethical issues into account in their analysis of decarbonisation pathways for Europe, including considering historical emissions and current wealth levels, Anderson and Broderick (2017) explain that a 'fair' emissions reduction pathway even to 2°C would mean that in Europe no fossil fuels can be burnt by 2035. While this more rapid decarbonisation pathway has not been adopted by the UK Government, it does show that even the UK's own targets for the rate of decarbonisation are not universally seen as in line with international obligations. Overall however, the need for rapid decarbonisation of the UK's heat sector is clear.

In addition to the UK's own climate change reduction goals, the European '20 20 20 Energy and Climate Package' placed targets on member states for carbon reduction, growth in renewable energy and improvements in energy efficiency (EU Commission, 2018). As a result of this package, the UK is obliged to reduce greenhouse gas emissions by 16% compared to 2005, increase the proportion of renewable energy in the energy mix to 15% by 2020 and reduce expected energy consumption by 18% compared to business as usual expectations (EU Commission, 2018). With the UK Government stating that the UK will leave the EU in 2019, it is unclear whether these targets will be maintained. It is however possible that these targets have had some previous impact on UK energy and heat policy.

2.3 THE ROUTE TO DECARBONISED HEATING

Since the introduction of carbon reduction targets in the UK, various pieces of analysis have considered the technological pathways for the decarbonisation of the energy (and heat) system. This section gives an overview of the key analysis to date and is based on a literature review by Lowes et al. (2018b) carried out as part of the UK Energy Research Centre (UKERC) Heat, Incumbency and Transformations project.

2.3.1 UKERC 2050 scenarios

Some of the earliest work which considered the long term future of UK heat (although not specifically heat but the long term future of the energy system under carbon targets) was carried out by UKERC. Since 2006, UKERC has been working on energy system modelling considering the UK energy system in 2050. In 2009, it released results from this modelling work which considered potential energy systems subject to various levels of carbon constraint using an updated version of the MARKAL energy system model (UKERC, 2009). The modelling showed that under 80% emission reduction scenarios, both reductions in heat demand and the shift to heat pumps[7] powered using electricity would be important for the domestic and services sector.

Energy demand would need to be reduced by around 10-15% in the service sector and by between 20-25% in the residential sector. The report adds, '*when looking at the decarbonisation of end-use technologies, in general, the residential sector is decarbonised by shifting to electricity (from gas) as well as technology switching from boilers to heat pumps for space heating and hot water heating*' (p45). Decarbonising heat in the service sector was suggested to also involve a switch to electricity but could also see an increase in the use of biomass (UKERC, 2009, p45). The UK's first long term scenario for a decarbonised space and hot water heating consisted of reductions in the demand for heat alongside an almost complete switch to heat pumps which would be powered by low-carbon electricity.

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[7] 'Heat pumps use electricity to absorb heat from either the air, ground or water. This heat can then be used to heat radiators and underfloor heating systems and to provide hot water'. (National Audit Office, 2018, p5)

2.3.2 Early 'heat strategy' development

Following the early UKERC work, in 2010 DECC (The Department of Energy and Climate Change, at the time responsible for UK energy and climate change policy) released '2050 pathways analysis' which considered various technological pathways that were seen to be able to meet the 80% carbon reduction target (DECC, 2010a). Much like with the previous UKERC research, the DECC analysis suggested that across all pathways considered, a significant move to electricity for space and hot water heating (using heat pumps) would be required with a potential role for the use of waste heat and solar thermal.

Later in 2010, the same version of the MARKAL model used by UKERC for the 2050 analysis was then used to underpin the advice from the Committee on Climate Change (CCC) for the fourth Carbon Budget (2023-2027) (Committee on Climate Change, 2010). The CCC explained: '*Direct emissions from heat in buildings are reduced significantly by 2030, as a result of major improvements in energy efficiency and roll-out of low-carbon heat, especially heat pumps. Beyond 2030, further reductions are required, through energy efficiency improvement, further deployment of heat pumps where suitable (e.g. to cover around 60% of homes and the large majority of non-residential buildings), possibly combined with conventional electric heat and a potentially important role for district heating in those built-up urban areas for which heat pumps are not suitable. A feasible pace of deployment could almost fully decarbonise heat in buildings by 2050*' (p29). The Committee on Climate Change's scenario for a decarbonised heat system like others, suggested high levels of demand reduction and high levels of electrification. It also included a significant level of district heating, where heat from low-carbon sources is piped directly to buildings in urban areas where heat demand is the highest (and so heat networks are the most cost effective).

In March 2012, based on various pieces of analysis, DECC released 'The Future of Heat: A strategic framework for low-carbon heat' which for the first time, outlined the Government's view, specifically on the long term future of heat in the UK (DECC, 2012e). DECC drew out common messages from all of the research, explaining that all scenarios eliminated fossil gas from the heat energy mix, showed a major role for electric heat pumps at a building level and phased out the use of oil, coal and resistive heating. Much like with the CCC's

previous advice in 2010, DECC's 2012 scenario for heat consisted primarily of reduced demand for heating, heat networks providing building level heat and individual heat pumps in areas where heat networks don't make economic sense (DECC, 2012e). As shown in Figure 2-4, the Government's 'strategic framework for low-carbon heat in buildings' suggested that in order to meet the carbon reduction targets, heat demand would be reduced through energy efficiency measures; simultaneously the use of gas for space and hot water heating would be squeezed out by electrically driven heat pumps in more rural areas and district heat networks in urban areas. The 2012 DECC heat strategy work was released as a consultation exercise as it was recognised that the proposed changes would have major social and technological implications for the UK. In chapter 8, policy episode 8 considers elements of socio-political power associated with the development of this initial heat strategy document.
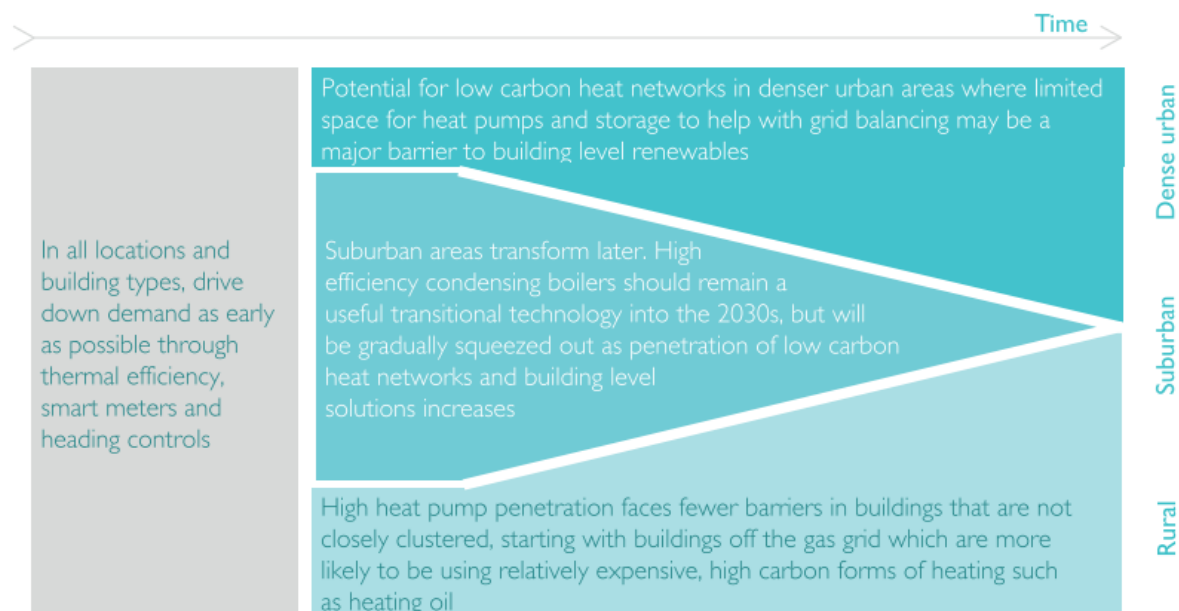
Figure 2-4. Government's strategic framework for low carbon heat in buildings (DECC, 2012, p97)

Separate to the DECC work on the heat strategy, in April 2012, The Committee on Climate Change released the results of heat system modelling carried out by AEA and Element Energy, produced in the context of the CCC's international aviation and shipping review (Committee on Climate Change, 2012). The analysis by the CCC suggested that a 2050 low-carbon heat system would primarily be using heat provided by heat pumps and through district heating, although the split between the two different technologies was a major uncertainty (Element Energy and AEA, 2012).

2.3.3 A potential role for gas in a low carbon heat system?

Later in 2012, consultancy 'Delta ee' released scenario analysis research focusing on the UK's domestic heat sector up to 2050 funded by the Energy Networks Association Gas Futures Group, a group made up of gas network owners (Delta ee, 2012). This bottom up modelling suggested that if some gas heating was maintained through both the supply of biogas as well as the more efficient use of gas in appliances including gas boiler/heat pump hybrids, it would be much more acceptable to energy consumers because not all consumers would need to switch away from gas; it also suggested this approach would have much lower energy system impacts. The study suggested that there would be major energy system costs as a result of moving the peak heat demand currently provided by the gas system onto the electricity system, due to an increase in requirements for both electricity generation and network capacity. The authors therefore suggested that maintaining the gas system and using gas to provide peak heat through hybridised appliances, may be a more sensible option.

It's important to note that as a result of the continued gas use, the carbon reduction of this scenario (90%) is lower than the fully non-gas scenario also explored in the report (96% potential carbon reduction). The hybrid scenario also requires the maintenance of two sets of networks (gas and electricity) and requires customers in many situations to have two appliances, a gas boiler and an electric heat pump. However, even in this 'balanced' scenario which has some role for gas appliances, there is still a major role for electrification and heat networks; in 2050, under this scenario, a quarter of households use district heating, half use electric heat pumps and the final quarter use a lower carbon gas appliance of some variety such as hybrids.

In March 2013, DECC released 'The Future of Heating: Meeting the Challenge', an updated heat strategy document which had been produced in light of responses to the 2012 DECC heat strategy document and further research and energy system modelling (DECC, 2013k). Policy episode 10 in chapter 8, considers elements of socio/political power associated with this 2013 document. The updated modelling used Redpoint's (now Baringa) RESOM model and also used the Energy Technology Institute's ESME model. These models included a

greater number of technologies for heat and also used a higher temporal resolution than the previous modelling.

The greater level of temporal granularity used in the models was recognised as being particularly important as its inclusion represented much more clearly the very short term peaks for heat which occur in the UK heat system. The UK's current heat system which has a high number of gas boilers and relatively inefficient buildings means that heat in the UK sees two significant peaks across the day, one in the morning and one in the evening when people turn their heating on and use hot water (Sansom, 2014). This so called 'peak heat' issue had not been considered in detail in previous heat modelling however the updated modelling, by using higher temporal granularity, represented these peaks much better (DECC, 2013j).

As a result of the changes to the modelling approach, the updated modelling for space and hot water heating suggested that while in 2050 there would still be no role for gas boilers, up to 2050 there may be a greater role for fossil gas used for heating. Gas could be used in smaller volumes and in different appliances such as gas absorption heat pumps and hybrid systems using an electric heat pump with a gas boiler. This increased potential role for gas was because the continued use of gas to provide heat peaking ability reduced the impact on demand on the electricity system therefore reducing system costs (DECC, 2013k). DECC's framework for heat was therefore updated to show this slight shift away from full electrification and district heating to a scenario where in the time before 2050 a higher level of gas was used (see Figure 2-5). It is however important to note that even after this change to the heat strategy framework, in DECC's scenarios, in line with the 80% carbon reduction target, in 2050 the vast majority of heat was still expected to be provided through heat networks or by using electric heat pumps with some reduction in heat demand, much like in the previous framework.
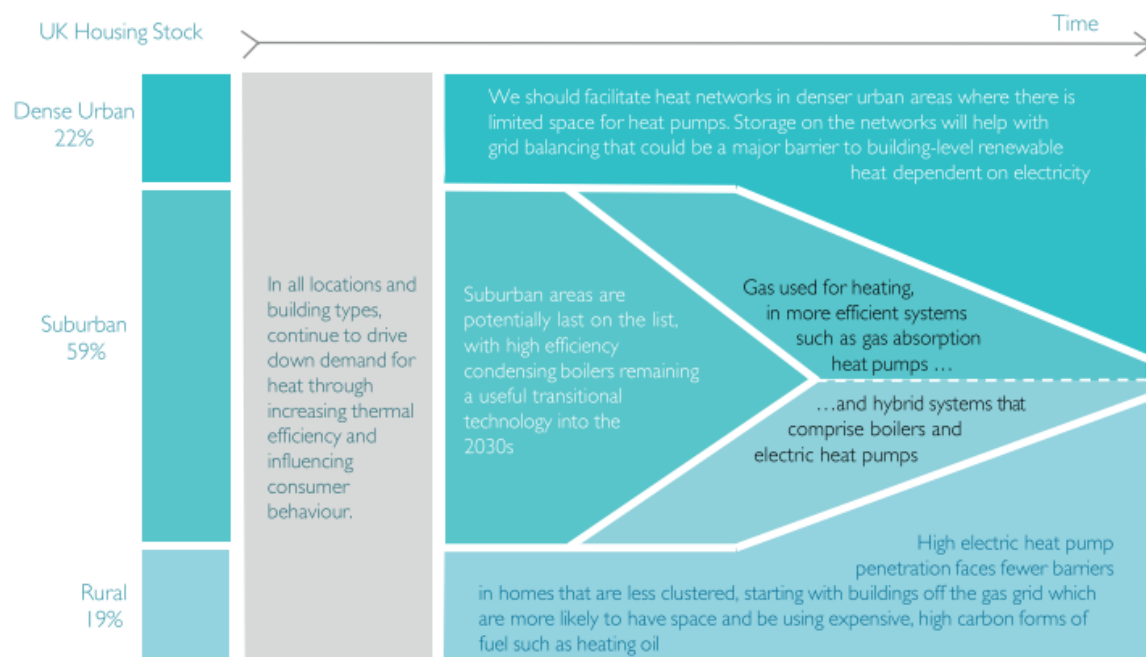
Figure 2-5. DECC's updated strategic framework for low-carbon heat in buildings over time

2.3.4 Ongoing heat in buildings analysis

Since DECC released its updated heat strategy in 2013, there have been no major policy or political announcements on the future of heating in the UK although in December 2018 the Department for Business, Energy and Industrial Strategy did release a comprehensive evidence review on heat decarbonisation (BEIS, 2018b).

Other actors have been releasing their own scenarios and thoughts around low carbon heat futures. The Committee on Climate Change produces annual progress reports in terms of reducing carbon and produces advice on how future carbon budgets can be met. Specifically on heat, for its 2013 advice on the fourth carbon budget, the period from 2023 – 2027, The Committee on Climate Change commissioned new analysis through Frontier Economics and Element Energy to consider the future of the heat sector (Committee on Climate Change, 2013). This review did not propose any major changes to the long term low-carbon heat solution but suggested that in the shorter term i.e. for the fourth carbon budget, there could be a lower level of heat pump uptake than had been previously suggested primarily because of (among other things) a higher potential for district heating (Committee on Climate Change, 2013). In their own words:

- *'We have revised our uptake down from 7 million heat pumps in homes to 4 million by 2030 (i.e. 13% of homes have heat pumps in 2030, rather than 21%), along with lower deployment in non-residential and industrial buildings.*
- *This is offset to a degree by higher uptake of district heating – increased from 10 TWh to 30 TWh (i.e. from 2% to 6% of buildings heat) in 2030.'*

<div align="center">(Committee on Climate Change, 2013, p45)</div>

Heat pumps and district heating are so central to the Committee on Climate Change's vision for low-carbon heat in buildings, that the number of heat pump installations are tracked on an ongoing basis and the committee has called for greater efforts to collate data on the number of heat network connections (Committee on Climate Change, 2016a).

2.3.5 Consensus on a low-carbon heat future?

As described in the previous sections, between 2006 to the present day, there has been a significant body of work undertaken in order to consider and produce scenarios for low-carbon heat in buildings in the future. In all of the work which considers carbon reduction, at least in line with the UK's climate change target, major changes in the provision of heat are seen to be necessary with all studies suggesting a greater role for electrification of heating using heat pumps and increases in the use of district heating. Much of the work also suggests a far smaller or even potentially non-existent role for natural gas in heating.

Chaudry *et al.* (2015) explain that while a number of uncertainties exist within analysis of UK heat decarbonisation, there are common messages for the future of heating (Chaudry *et al.*, 2015, p628); these messages are:

- '*Energy demand reduction is essential for meeting emission targets'*
- *'A substantial level of electrification of heating (via heat pumps) is expected'*
- *'District heating will play an important role in heat supply decarbonisation*'

While Eyre and Baruah (2015) agree that a much greater role for electric heating is likely, they explain that there may be a much more significant role for reducing heat demand using energy efficiency measures than Government models have suggested; in light of this, bio-energy (which is limited in quantity by supply issues) may be able to play a bigger role in domestic heat (as biogas or biomass) than has been suggested elsewhere. Elsewhere, it has also been

suggested that storage heating which uses off-peak electricity may have value in certain situations in order to reduce the impact from the potential increase in resistive electric heating (Darby, 2018). Overall it appears that while there may be some elements of certainty, particularly around the need for heat electrification, there is still substantial uncertainty around the specifics of a low carbon heat system.

2.3.6 Dissent from the electrification and district heat vision

Although there has been a fairly strong consensus on the need for electrification of some heat demand, not all actors' views align with that consensus. For example, section 2.3.3 discussed modelling produced for the Energy Networks Association's Gas Future Group by Delta ee which suggested a higher role for gas for heating in the future that had been suggested elsewhere (Delta ee, 2012).

Scenario analysis by Delta ee was also used by trade body The Heating and Hot Water Industry Council (HHIC), a trade association which represents the UK hot water and heating industry and is a member of the larger Energy and Utilities Alliance group of trade bodies. Much like with the previous Energy Networks Association scenarios, the HHIC scenarios suggested a more 'balanced' rollout of technologies to 2030 which included lower carbon gas appliances such as: micro-combined heat and power, gas powered heat pumps and hybrid systems using a gas boiler plus a heat pump (HHIC and Delta ee, 2013). This scenario was expected to provide more flexibility, better choices for consumers and reduce impacts on the electricity system (HHIC and Delta ee, 2013). However, as this scenario analysis relied on the same modelling used by the ENA, this scenario does not put the UK on a path to fully decarbonised heating, which is recognised as being vital for the UK's wider decarbonisation goals in line with the Climate Change Act.

While there has been some dissent from the consensus on the decarbonisation of heat, the two examples described above which propose higher levels of gas use have been developed and promoted by the incumbent heat actors, via the trade association which represents gas network companies (The Energy Networks Association) and trade association which represents existing heat

interests such as appliance manufacturers (Heating and Hot Water Industry Council).

A major project which formed part of the UK Energy Research Centre's third phase, and on which this author was lead research fellow, investigated ideas of incumbency in the UK heat sector.

The key publications from this research:

- Developed a working definition of incumbency and considered how it could be applied to the UK's heat sector (Lowes et al., 2017);
- Analysed the structure and make-up of the UK heat sectors and investigated the risks posed to incumbents by heat decarbonisation (Lowes et al., 2018a);
- Investigated the behaviours of UK heat incumbents associated with decarbonisation highlighting directed innovation and lobbying. This report also highlighted the policy implications associated with the behaviour of incumbents (Lowes et al. 2018b);
- Provided a short policy briefing for the project (Lowes and Woodman, 2018).

Overall, that research showed that in recent years, incumbents in the gas sector, particularly actors associated with gas networks and gas heating appliance manufacturers have been heavily promoting ideas of decarbonising the gas grid with low-carbon gases (focusing on hydrogen). The efforts of incumbents appear to be in response to the threat that heat decarbonisation, and specifically heat electrification, creates for these companies. The low carbon gas technologies have been promoted in attempts to influence the Government's view on the potential future role for gas and increase support for the future role of gas in the UK's heat system.

In particular, the key behaviours of incumbents identified highlighted the use of political lobbying to attempt to influence policy makers so that they support the option of low carbon gas. This attempted political influencing took place alongside 'innovation' activities which were designed to show that low carbon gas could become an important heat vector. At the same time, the idea of

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decarbonising the gas grid using low carbon hydrogen has increasingly been seen as a potential heat decarbonisation solution by the Government.

While the current Government has said little about their view of, or vision for the long term future of heating, in their 2017 'Clean Growth Strategy', they propose two potential low carbon heat scenarios, one based around the more traditional approach to heat decarbonisation of increased electrification and another scenario which sees much of the gas grid converted to hydrogen (HM Government, 2017b). The UK Government explain that '*at present it is not certain which approaches or combination of them will work best at scale and offers the most cost-effective long-term answer*' and before decisions can be made, a greater understanding of the pathways is required (HM Government, 2017b, p75). Two recent significant reports by UK Government advisors have highlighted the current uncertainty of heat decarbonisation options. Analysis for The National Infrastructure Commission suggested pathways existed for full electrification, full conversion of gas heating to hydrogen and hybrid pathways. This report suggested that hydrogen conversion may be slightly cheaper than an electrification approach for heat decarbonisation, but across all scenarios, there was significant uncertainty over costs and technical performance; the authors suggested policy makers should focus on energy efficiency and support research and development into low carbon heat (Element Energy and E4tech, 2018).

A report for the UK's Committee on Climate Change highlighted similar scenarios to the work for the NIC but suggested that hybrid approaches (where heat systems comprise small heat pumps alongside gas boilers used for peaking) may provide the most cost effective solution for heat decarbonisation. This analysis also suggested that because of the fugitive emissions associated with producing hydrogen from natural gas with CCS, a wholesale conversion of the UK's gas grid to hydrogen may not reach levels of decarbonisation suitable for net-zero (Strbac et al., 2018). The CCC's hydrogen review and report on 'net-zero' both suggested that while hydrogen may be able to play some role in heat decarbonisation, electrification looks likely to be the optimum solution for much heat decarbonisation (Committee on Climate Change 2018c and 2019 respectively).

In a Government publication which gave an overview of the current evidence base for UK heat decarbonisation published in December 2018, Government announced a new heat policy roadmap to be published within eighteen months (BEIS, 2018b).

While the recent UK heat policy developments and associated work on incumbency are of interest to this thesis, the focus of this analysis is on the period up to 2015, before the incumbency research started.

2.3.7 Space and hot water scenarios overview

An increasing body of evidence and a number of scenarios have emerged over the past thirteen years considering the future of heat in the UK in light of carbon reduction requirements. Eliminating the use of fossil fuel combustion for space and hot water heating is a requirement in all scenarios yet fossil fuels are currently used for the vast majority of heat use.

Reducing the demand for heat is seen as centrally important in order to both protect the most vulnerable energy users and to reduce overall heat system costs. Scenario analysis has also generally shown that as well as reducing demand for heat, much of the heat which is still required is provided by either electric appliances such as heat pumps at a building level, or provided through district heat networks (these district heat networks may themselves use large heat pumps which rely on electricity). In these scenarios, electricity is decarbonised making it a low carbon source of energy. It has also been recognised, that there may be a role for some bio-energy to decarbonise UK heat either in the form of biomass or biogas however, how and where this should be used and the availability of bio-energy resource are uncertain (Eyre and Baruah, 2015).

More recently, scenarios and visions of a future heat system have emerged which maintain the UK's gas based system, but see this decarbonised using forms of low carbon gas such as hydrogen. However, this low-carbon gas approach is deeply uncertain and is being promoted by incumbents in response to the threat of decarbonisation.

Clearly, major changes for how space and hot water heating are provided in the UK are required as a result of objectives for decarbonisation. These changes could impact, involve or potentially challenge a variety of actors. In order to

drive these changes and associated actors, government intervention is widely seen as needed to drive heat decarbonisation (Policy Exchange, 2016; Committee on Climate Change, 2016b; HM Government, 2017b). Indeed, the Government itself has recently explained that '*Decarbonising heat is our most difficult policy and technology challenge to meet our carbon targets*' (HM Government, 2017a, p75).

2.4 UK GOVERNMENT POLICIES AND APPROACHES FOR HEAT GENERATION DECARBONISATION

This section considers the previous and current UK government policy which has attempted to deliver low carbon heat technology. It aims to build a basic policy background upon which the empirical sections can build. Overall, policies promoting low carbon heat in the UK have only delivered limited quantities of low carbon heat. While renewable heat is not necessarily the same as low carbon heat (an issue considered in annex 5), the renewable energy technologies which have and are being promoted by UK policy (air and ground source heat pumps, solar thermal and bio-energy) are all seen as potentially important low-carbon heat technologies and have been supported for their low carbon as well as renewable attributes. Therefore for the sake of this section, renewable heat support can also be taken to mean low carbon heat support.

2.4.1 Early renewable heat support

The earliest policy specifically aiming to support low carbon heat deployment was the Clear Skies Programme which operated between 2003 and 2006 (Connor *et al.*, 2015). The Clear Skies programme delivered 6434 grants for renewable energy systems, these included solar and biomass technologies but precise numbers of installations split by technology and whether they are for the production of heat cannot be determined (Department for Trade and Industry, 2006). The Low Carbon Buildings programme followed the Clear Skies Programme and between 2006 and 2010 supported 8,545 solar thermal systems, 5,805 biomass boilers and 2,399 heat pumps out of a total of 18,240 grants (DECC, 2011b). While these schemes delivered some small quantities of renewable heat, even if all the Clear Skies heat delivery was associated with heat, these two programmes would have delivered just over 21,000 low carbon heat installations, around 3300 per year. If as described in section 2.1, 150,000

connections are being made to the gas network each year, the Clear Skies and Low Carbon Buildings Programme will have had only a minor impact on the UK heat system.

2.4.2 The Renewable Heat Incentive (RHI)

The RHI is the UK Government's key current policy measure to grow the deployment levels of low carbon and renewable heat generation in the UK. This section and the sub-sections within it, consider the RHI's development and performance to date. The RHI scheme considered here supports the deployment of renewable heat in Great Britain only (i.e. it does not apply to Northern Ireland). It should however be noted that a separate RHI scheme did operate in Northern Ireland which is the subject of an ongoing inquiry[8].

The 2007 UK Energy White Paper made a commitment to conduct further work to investigate the policy options for low carbon heat (Department for Trade and Industry, 2007). This commitment was also outlined by the then Prime Minister Gordon Brown who said '*we will introduce new measures to bring forward renewable heat, with a call for evidence in January prior to a full consultation*' (Telegraph, 2007).

In January 2008, the Department for Business, Enterprise and Regulatory Reform (BERR), the department then responsible for energy (including heat) released a call for evidence on the subject of heat which outlined some potential financial support policies for heat; these were a capital grant based system, a 'Feed in Tariff' system (which would provide payments to producers of renewable heat) and an obligation/quota system (which would require energy suppliers to ensure that a proportion of their heat supplies came from renewables) (BERR, 2008a). A few months later in June 2008, BERR released a consultation into the UK's 'Renewable Energy Strategy' which considered the potential options for promoting renewable energy in more detail in order to make progress towards the EU's 2020 renewable energy target. This consultation introduced the Government's preferred options for the support of

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[8] As well as creating the powers for the GB RHI, the 2011 HM Government Energy Act created the power for the Northern Ireland government to run a renewable heat incentive but that scheme has run separately and is subject to different legislation and regulation.

renewable heat, a 'Renewable Heat Incentive (RHI), or a Renewable Heat Obligation'.

At the end of 2008, the legislation for a tariff-based incentive mechanism to support renewable heat which came to be known as the Renewable Heat Incentive (the RHI) was introduced alongside legislation for the Feed In Tariff (FIT) which supported small scale renewable electricity generation (Parliament, 2008d). The introduction of this legislation was driven partly by industry (the power and detail associated with the introduction of this legislation is considered in policy episode 2 in chapter 8). The final Energy Act 2008 contained little about how the scheme would be operated beyond what types of technologies could be supported and simply provided DECC with the ability to financially reward renewable heat through some sort of levy on fossil fuel suppliers (Parliament, 2008d).

The Heat and Energy Saving Strategy consultation, released in February 2009, followed the laying of the primary legislation in the 2008 Energy Act. The consultation explained that DECC expected the RHI to broadly take the form of the scheme which had previously been set out in the 2008 Renewable Energy Strategy Consultation but the preferred design was an incentive mechanism rather than a supplier obligation which had been seen as a competing option (DECC/DCLG, 2009). An obligation would have been designed similarly to the 'Renewables Obligation' which supported renewable electricity and would require fossil fuel suppliers to procure certificates to demonstrate that a proportion of their supplied heat came from renewable sources (DECC/DCLG, 2009). The proposed model for the Renewable Heat Incentive contained within the Renewable Energy Strategy Consultation was:

- Any heat user producing renewable heat would be entitled to claim a set per MWh payment from a central fund or an obligated supplier.
- For small installations, payments would be expected to be based on the 'deemed' (or estimated) heat demand of a building rather than requiring metering.
- A method for spreading payments across suppliers would be introduced.
- The scheme could alternatively be operated by a central body.

- The scheme costs would be passed onto buyers of non-renewable fuels through suppliers.
- The level of financial support paid to an installer of renewable heat would be known in advance.
- The value of payments would be important for driving uptake under the scheme.
- Smaller heat users may need to access upfront financial support in order to assist with capital investment costs.
- The energy industry would be expected to market products which would be supported under the RHI.

Exactly why the incentive rather than obligation was preferred at this point is not explained in the Heat and Energy Savings Strategy consultation (DECC/DCLG, 2009). However, the Government explained in the previous Renewable Energy Strategy consultation that '*An obligation could fit well with the UK's existing market-based policy landscape. Being a market mechanism, it would allow the market to search out the lowest cost opportunities for the installation of renewable heat';* the strategy did however recognise issues with whom the obligation would be on and the difficulty with measuring heat output and setting obligations (BERR, 2008b, p116).

The Heat and Energy Saving Strategy consultation continued with the idea that the RHI would be funded by a levy on fossil fuel suppliers and DECC expected the scheme to be running by April 2010 (DECC/DCLG, 2009). Following the 2010 general election which resulted in the Liberal Democrat/Conservative coalition Government, there were uncertainties over how the RHI would be funded. However, in October that year it was announced that funding would be made available for the RHI but this would come from Government revenues rather than from fossil fuel suppliers (the subject of policy episode 4 in chapter 8) (HM Treasury, 2010b).

Initially the RHI opened only for non-domestic applications in November 2011. The initial focus on non-domestic renewable heat is considered in policy episode 6 in chapter 8 and resulted from a Government decision to initially focus on the lower cost areas of renewable heat. Further details of domestic renewable heat support is considered in section 2.4.2.2.

The non-domestic RHI continues to this day to provide qualifying new renewable heat installations with a fixed payment for each unit of renewable heat produced for 20 years (DECC, 2011c). The initial non-domestic tariffs and supported technologies are shown in Table 1. As can be seen in Table 1, small and medium biomass installations received a tiered tariff where the first units of renewable heat produced each year received a higher tariff and beyond a tier threshold, further heat generated received a lower tariff. This mechanism was designed to attempt to ensure that there was not an incentive to burn more biomass in order to make greater financial returns.

Tariff name	Eligible technology	Eligible sizes	Tariff rate (pence/ kWh)
Small biomass	Solid biomass; Municipal Solid Waste (incl. CHP)	Less than 200 kWth	Tier 1: 7.6 Tier 2. 1.9
Medium biomass		200 kWth and above; less than 1,000 kWth	Tier 1: 4.7 Tier 2: 1.9
Large biomass		1,000 kWth and above	2.6
Small ground source	Ground-source heat pumps; Water-source heat pumps; deep geothermal	Less than 100 kWth	4.3
Large ground source		100 kWth and above	3
Solar thermal	Solar thermal	Less than 200 kWth	8.5
Biomethane	Biomethane injection and biogas combustion, except from landfill gas	Biomethane all scales, biogas combustion less than 200 kWth	6.5

Table 1. Non-domestic RHI tariffs at the time of scheme introduction in November 2011 (DECC, 2011c)

2.4.2.1 Early modifications to the RHI

During 2012, DECC released a number of consultations considering further development of the RHI scheme. The July 'Providing certainty, improving performance' consultation proposed the introduction of a tariff degression budget management system which would reduce tariff levels if deployment of a particular technology went above pre-determined levels. It also proposed the introduction of sustainability requirements for bioenergy[9] alongside other more minor changes (DECC, 2012d). The proposed introduction of the degression system followed the introduction of a short term cost control measure which would quite simply close the scheme to new applications if a spending threshold was reached. There were concerns that the RHI could grow much faster than expected as had happened with the Feed in Tariff policy for electricity and therefore, the scheme could cost more than expected. Lord Marland, a minister at DECC, explained regarding the introduction of the cost control that '*we have learnt lessons from FITs*' (Hansard, 2012).

In September 2012, before responding to the July consultation, DECC consulted further on the RHI. The consultation document, 'Renewable Heat Incentive: Expanding the non-domestic scheme' proposed that extra technologies should be included in the scheme, including an uplift for the use of combined heat and power and a specific geothermal heat category. The consultation also included calls for evidence on other potential technologies including landfill gas, ground source heat pumps and biopropane (DECC, 2012b). At the same time, a short consultation was also released into the proposed inclusion of air source heat pumps (ASHPs) and energy from waste for heat (DECC, 2012c).

The degression system to manage scheme spending was eventually introduced in 2013. This automatically decreases specific technology tariffs by pre-determined amounts if one particular technology is deploying faster than expected (DECC, 2013d). Later in 2013 a number of further changes were introduced for the RHI. This included the addition of new technologies into the non-domestic RHI including air to water heat pumps, biomass combined heat

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[9] The introduction of sustainability criteria was expected and the 2011 RHI document mentioned this previously (DECC, 2011c)

and power systems, biogas combustion and deep geothermal (DECC, 2013e).
At the same time, DECC explained that tariffs for large biomass systems, solar
thermal and ground source heat pumps were to be increased to the levels
shown in Figure 2-6. This was in order to increase the deployment of these
technologies which had not been deploying at their expected levels.

Technology		Current tariffs[1,2]	Reviewed tariffs (proposed for 2014/15)
Biomass Boilers	Small (up to 200kW)	Tier 1: 8.6, Tier 2: 2.2	NO CHANGE
	Medium (200kW to 1MW)	Tier 1: 5.3, Tier 2: 2.2	
	Large (1MW and above)	1.0	2.0
GSHPs	Small (up to 100kW)	4.8	7.2[3] – 8.2[4]
	Large (100kW and above)	3.5	
Solar Thermal (up to 200kW)		9.2	10.0 – 11.3

Figure 2-6. Proposed new RHI tariffs (DECC, 2013f)

In the same 2013 document, DECC also explained that because certain
technologies were deploying much faster than others, namely small and
medium biomass (as shown in Figure 2-7), it looked likely that the previously
introduced budget management system would reduce the small and medium
biomass tariffs. However, overall the scheme was underspending and a
reduction to the biomass tariffs could mean that much of the scheme's budget
would be unspent.

Technology	Anticipated expenditure for subsequent year (£m)	Actual forecast expenditure (£m)	Forecast expenditure as % of anticipated
	Consistent with DECCs trajectory towards achieving the 2020 heat target	*Based on actual data provided by Ofgem*	*Actual forecast as a percentage of anticipated expenditure*
Small Biomass (< 200kW)	14.8	18.6	126%
Medium Biomass (200kW to 1MW)	13.4	22.6	169%
Large Biomass (> 1MW)	23.1	5.2	23%
Small GSHP (< 100kW)	28.9	0.4	1%
Large GSHP (> 100kW)	4.9	0.5	10%
Solar thermal (< 200kW)	4.9	0.04	1%
NOT IN SCOPE Biomethane (all scales) and Biogas (< 200kW)	12	1.6	13%

Figure 2-7. 12 month forecast spend for RHI at 30th April 2013 (DECC, 2013f)

DECC explained that excess budget which was unlikely to be spent which had previously been allocated to other technologies could be spread to technologies which had delivered more capacity (i.e. small and medium biomass) in order to reduce the likelihood of their tariff being reduced by degression and therefore continue to support the well performing technologies (DECC, 2013f). This change was introduced and the industry involvement and impact on this budget management issue is considered in policy episode 12 in chapter 8 which considers the reasons for the Government's decision on the matter (section 8.12).

The 2013 document also explained that the Government would introduce rules associated with the sustainability of bio-energy being funded through the RHI. This would include a greenhouse gas reduction requirement and rules on the sourcing of bio-energy (DECC, 2013d). Policy episode 13 in chapter 8 specifically considers elements of power associated with the introduction of these new rules for producers of biomethane grid injection. Policy episode 13 also considers a further change specific to biomethane producers relating to a tariff modification and the introduction of a 'tiered' tariff for biomethane which Government consulted on during 2014 (DECC, 2014c).

No further policy changes were made to the non-domestic RHI in 2015 but in 2016, the Department for Business, Energy and Industrial Strategy (BEIS), the department now responsible for energy, consulted on and introduced further changes to the non-domestic RHI (BEIS, 2016). These changes included introducing a single biomass combustion tariff regime which applies to all sizes of installation and further tightening rules for the sustainability of bio-energy, by introducing limits on the volume of purpose grown energy crops used for the production of biogas. The scheme is expected to continue under these rules until its expected closure in March 2021.

2.4.2.2 Renewable heat support for households

As explained previously, the initial implementation of the RHI for households (the domestic scheme) was delayed (the power associated with this delay is considered in policy episode 6 in chapter 8) and in 2011 an interim policy called the Renewable Heat Premium Payment' (RHPP) was introduced. THE RHPP provided capital grants covering part of the costs of air source and ground

source heat pumps, solar thermal systems and biomass boilers and was taken up by around 15,000 households (DECC, 2014a).

The domestic RHI eventually opened in Spring 2014 and continues to reward homeowners who generate renewable heat with a fixed tariff for each unit of renewable heat produced for seven years (DECC, 2013a). Technologies supported by the domestic RHI are air and ground source heat pumps, biomass boilers and solar thermal heat generation. The original tariffs for the domestic RHI are shown in Table 2 and these tariffs have changed over time as they are linked to inflation and have been modified by Government.

Technology	Air source heat pump	Ground source heat hump	Biomass boiler	Solar thermal
Tariff (p/kWh renewable heat)	7.3	18.8	12.2	19.2

Table 2. Original domestic RHI tariffs as introduced in 2014. Data from (DECC, (2013h)

Like the non-domestic scheme, the domestic scheme is also subject to a budget management system and has requirements for the sustainability of biomass fuel sources. There are two key difference between the domestic and non-domestic schemes. Firstly, the domestic scheme uses estimated household heat usage (often referred to as deemed) as the basis for awarding payments rather than requiring that heat be metered (DECC, 2013a). Secondly, the domestic scheme initially targeted a rate of return of 7.5% for the additional capital expenditure compared to a fossil fuel heating system. For the non-domestic scheme, the targeted rate of return was 12%, apparently reflecting the availability of finance and required financial returns for different sectors (DECC, 2013b).

When changes to the non-domestic scheme were proposed in 2016, changes were also proposed for the domestic scheme. The key eventual change was the increase made to tariffs for air and ground source heat pumps to 10.02 pence per kilowatt- hour (p/kWh) and 19.55p/kWh respectively. This was in order to support the deployment of a greater number of these systems that were seen to be strategically important for the Government, but which had not been deploying at expected levels (BEIS, 2016). The biomass tariff was also increased from 4.28p to 6.54p as BEIS believed that the automatic tariff reductions had reduced the tariff so much, that deployment may be slower than

they hoped for and they supported some further growth in domestic biomass combustion (BEIS, 2016).

2.4.2.3 *Deployment resulting from the RHI*

Building on the previous two sections considering the domestic and non-domestic RHI, this section describes deployment under the schemes up to July 2018.

Firstly the non-domestic scheme is considered. Table 3 shows total technology deployment under the non-domestic RHI up to December 2018 (most recent at time of writing). This data splits deployment into the number of each type of technology and the amount of heat generated by each technology type. Small and medium biomass installations dominate the total number of installations representing 86% of all installations. Clearly other technologies have deployed significantly less, with deep geothermal seeing no deployment at all. With regards to the total heat delivery, the splits do not directly reflect the number of installations. This is because large installations, such as large biomass boilers and biomethane sites produce more energy per installation. Combined, biomass has produced 70% of all renewable heat with the majority of the rest of the renewable heat coming from biomethane (23%).

	Total number of accredited installations	Percentage of total accredited installations	Heat generated and paid for under scheme (GWh)	Percentage of heat paid for and generate under scheme
Small Solid Biomass Boiler (< 200 kW)	12,864	67%	8,567	29%
Medium Solid Biomass Boiler (200-1000 kW)	3,576	19%	9095	31%
Large Solid Biomass Boiler (> 1000 kW)	87	0%	3000	10%
Small Solar Thermal (< 200 kW)	314	2%	6	0%
Small Water or Ground Source Heat Pumps (< 100 kW)	804	4%	109	0%
Large Water or Ground Source Heat Pumps (>100 kW)	203	1%	259	1%
Biomethane	89	0%	6661	22%
Biogas	661	3%	1,471	5%
Air Source Heat Pumps	466	2%	35	0%
CHP	61	0%	502	2%

Deep Geothermal	0	0%	0	0%
Total	19,756	100%	25,710	100%

Table 3. Total numbers of renewable heat installations and total amount of heat produced under the non-domestic RHI up to December 2018. Data from (BEIS, 2018h)

BEIS data also shows the monthly number of applications to the non-domestic RHI split by technology (BEIS, 2018h). This data shows how small biomass applications dominated the first part of the scheme up to June 2015 and peaks in installation numbers occur in advance of automatic reductions to the small biomass tariff (inferred from Ofgem, 2018, data). Installers appear to rapidly install systems before tariffs were reduced to ensure installations receive higher tariffs. After June 2015, medium sized biomass became a much more popular technology under the scheme and this reflects an automatic tariff change as a result of budget management; this meant that medium sized biomass installations received a higher tariff than small biomass boilers therefore incentivizing the installation of larger boilers (Ofgem, 2018c).

Overall, bio-energy has dominated the non-domestic RHI. The original Government impact assessment for the non-domestic RHI policy suggested that heat from biomass was expected to contribute to around 49% of heat supported by the RHI and heat from biogas would form around 7% of all heat produced (DECC, 2011d). However, as has been shown, the proportion of biomass under the scheme is much higher than was originally anticipated and this appears to be partly as a result of the increased budget awarded to biomass discussed in section 2.4.2.1. The power associated with this policy change is considered in more detail in policy episode 12 in chapter 8.

Deployment under the domestic RHI scheme has been more balanced than under the non-domestic RHI and total delivery up to July 2018 is shown in

Table 4. Air source heat pumps have been the most popular technology making up over half of all installations. However, over half of the renewable heat produced as a result of the domestic RHI has been produced by biomass combustion. This may reflect higher levels of heat demand in homes where biomass is used (because homes are likely to be larger) and the BEIS data show that maximum heat output capacities of biomass boilers are over double the capacity of heat pump systems (BEIS, 2018h) (likely because biomass boilers normally have a higher capacity than heat pumps to heat bigger homes).

This could also reflect the fact that not all heat pump heat output is counted as renewable; specifically the electricity inputs used to run heat pumps are netted off from total heat output (DECC, 2013b).

Technology	Total number of accredited installations	Percentage of total accredited installations	Heat generated and paid for under scheme (MWh)	Percentage of heat paid for and generate under scheme
Air source heat pump	34,790	53%	1,016,084	31%
Ground source heat pump	9,621	15%	528,253	16%
Biomass systems	12,645	29%	1,693,094	52%
Solar thermal	8,850	13%	48,434	1%

Table 4. Total numbers of renewable heat installations and total amount of heat produced under the domestic RHI up to December 2018. Data from (BEIS, 2018h)

While the domestic RHI has been more balanced, the original impact assessment produced by the Government in advance of the domestic RHI scheme suggested that 9% of expected installations under the RHI would be biomass boilers, whereas the largest proportion (46%) would be for ASHPs, 25% for solar thermal and 20% for GSHPs (DECC, 2013b). Like in the non-domestic scheme, in the domestic RHI, biomass is also delivering a greater proportion of installations than was anticipated.

Deployment data show that for the first year of the domestic RHI, biomass combustion was the most popular technology, but since around July 2015, air source heat pumps have been more popular. The reduction in deployment of biomass appears to be a result of repeated (6 in total) automatic reductions in the biomass tariff due to biomass deploying beyond expected levels (Ofgem, 2018a). While the tariffs for biomass and heat pumps were increased in January 2018 (as described in section 2.4.2.2) the deployment data does not suggest that these new tariffs have yet increased deployment of these technologies.

2.4.2.4 Recent analysis and the future of the RHI

Throughout 2017 and 2018 the National Audit Office (NAO), the Government spending watchdog, reviewed the performance of the RHI to date and released their final report in February 2018 (National Audit Office, 2018). As well as considering issues such as non-compliance and value for money, their review

also concluded that under current forecasts the RHI is expected to deliver 65% less renewable heat than it was originally expected to and will deliver only 22% of the expected number of installations (National Audit Office, 2018). Following the report by the NAO, the Public Accounts Committee (a group of MPs who oversee Government spending) carried out an inquiry into the RHI. This inquiry agreed with the NAO's assessment that deployment under the RHI had been much lower than expected and the RHI hadn't achieved its goal of delivering a supply chain for low carbon heating (Public Accounts Committee, 2018). The Government agreed with all of the Committee's recommendations (HM Treasury, 2018).

The RHI is expected to be open to applicants up to 2021. However, the Government has as yet announced no policy to replace it once it ends. BEIS have simply explained that: '*Beyond the RHI, our ambition is to phase out the installation of high carbon fossil fuel heating in new and existing off gas grid residential buildings (which are mostly in rural areas) during the 2020s, starting with new homes as these lend themselves more readily to other forms of low carbon heating*' although the Clean Growth Strategy does suggest there will be some form of successor policy (HM Government, 2017a, p79). BEIS is currently collating evidence regarding a future heat policy framework for buildings not connected to the gas grid (BEIS, 2018a).

2.5 CHAPTER SUMMARY

This chapter has outlined the key energy policy issues that are the basis of this thesis. It has described how the UK's current system for the generation and use of heat is based on fossil fuels and is incompatible with the UK's climate change targets. It has also explained that a transformation of the UK's heat system is needed and described analysis which has shown that in order to meet goals for decarbonisation, the UK needs to entirely stop burning fossil fuels for space and hot water heating. In order to decarbonise heating in the UK, as well as by reducing demand for heat, fossil fuels have been expected to be replaced with electrical heating technologies and heat networks in some urban areas. The UK Government's development of a heat strategy outlining its view on the future of heating was also described. The chapter also explained that more recently,

incumbent gas interests have been promoting the idea of using low carbon forms of gas in the gas grid.

Previous policies have deployed some low carbon heating technology however, the most significant low carbon heat deployment policy is the currently active RHI. The development of this policy has been described in some detail and it has been shown that the delivery of low carbon heat under the RHI has been skewed towards bioenergy in the non-domestic scheme and both the domestic and non-domestic schemes have significantly under-delivered.

Overall, this chapter has discussed the real world policy context of the thesis. The following four chapters consider the theoretical underpinnings of the thesis investigating theoretical approaches to consider the transformations of large systems such as the UK's heat system, exploring ideas of power (and how it links to policy change) and finally considering how ideas of power, policy change and system transformations are linked.

3 SUSTAINABLE TRANSFORMATIONS AND AN INCREASING INTEREST IN POWER

This chapter is the first of four chapters which together form the theoretical underpinning of this thesis. This chapter introduces the concepts of sustainable transformations and the multi-level perspective (MLP) model; these are related theoretical approaches which are used to consider the transformation of large and complex socio-technical systems such as the UK's heat system. The end of this chapter describes how approaches to transitions and transformations have frequently been critiqued because they appear to have overlooked the importance of power, but goes on to explain that researchers have been increasingly recognising the importance of power in transformation related research.

3.1 KEY CONCEPTS

The chapter introduction above included some language which requires a more detailed unpicking before going any further. The following sections therefore explore the term 'sustainability' and expand on the terms 'transition' and 'transformation' in order to provide readers with a useful definition or understanding of the use of these terms within this thesis .

3.1.1 Defining sustainability for heat

The term sustainability is central to discussions around transformations yet it is often not defined in this context. The widely used definition from the 1987 Bruntland Report considers sustainable development as '*Development that meets the needs of the present without compromising the ability of future generations to meet their own needs*' (p43, Brundtland, 1987). This definition however considers sustainability in the context of sustainable development and implies that continued economic development can be compatible with sustainability goals; an idea which has been questioned (e.g. Jackson, 2009). Others have suggested that economic growth is not a primary dimension of sustainable development but a potential means to drive sustainable development and so while economic growth should not be seen as a

requirement of sustainable development, it could be associated with sustainable change (Holden *et al.*, 2014).

During the 2002 UN Earth Summit in Rio, the 'Johannesburg Declaration' on sustainable development was agreed and built on the Bruntland definition. This declaration suggested that sustainable development consists of three independent but mutually reinforcing pillars: economic development, social development and environmental protection (United Nations, 2002). The focus on economic development in this definition implies that economic growth was seen to be a requirement for sustainable development. This question over the relationship between sustainability and economic growth while important is not the subject of this research and is therefore not discussed in any more detail.

Building on the Bruntland definition and the Johannesburg Declaration, for the sake of this thesis, *sustainability is understood as practices or activities linked to economics, society and the environment that meet the needs of the present without compromising the ability of future generations to meet their own needs.*

This project is fundamentally interested in the potential change of the UK's heat system towards a more sustainable system. Linked to the concept of pillars, this means a future heat sector which is economically, socially and environmentally sustainable. Economically, the system should be relatively low cost compared to other options, socially, the system should be equitable and in terms of sustainability, the system should have a reduced environmental impact.

These three pillars or elements of sustainability are clearly connected. For example, at a global level, decarbonising the energy system is primarily associated with environmental goals however, decarbonisation may also be socially beneficial as a result of potentially reduced climate change impacts. A lower cost energy system may also be more socially equitable than a high cost system as more people are able to afford energy.

The sustainability of energy systems is not however generally considered specifically in relation to the three pillars of sustainability. Instead, energy systems are often considered under another system formed of three aspects, referred to as the energy 'trilemma'. This term, used most notably by the World Energy Council, a UN accredited global body, considers energy sustainability as being based on three dimensions, energy security, energy equity and

environmental sustainability (World Energy Council, 2016). This energy trilemma approach has clear similarities to the pillars of sustainability approach. The term 'trilemma' has also been used by energy researchers such as Bolton and Foxon (2015) who suggest the trilemma involves elements of energy security, managing costs and achieving emission reduction targets.

While there may be agreement on the elements of the energy trilemma, views on what constitutes a sustainable energy system differ. For example, some UK research has suggested that a sustainable energy system is a: non-nuclear, primarily low-carbon, low energy demand system which emits 80% per cent less carbon by 2050 from 1990 levels, and meets its European energy obligations (Mitchell, 2014). This is however not the only view and The UK Government in its 2009 Low Carbon Transition plan suggested a '*world which is sustainable for future generations*' which included nuclear energy and fossil fuel use with carbon capture and storage (DECC, 2009, pV).

Clearly determining the sustainability of energy systems requires a number a normative judgements. In my view of a sustainable UK heat system, the heat system must be reliable, nearly fully decarbonised as is seen to be required by the UK Committee on Climate Change (Committee on Climate Change, 2016b), have lower levels of energy demand to reduce system stress and minimise decarbonisation costs, and have an equitable sharing of costs with very low levels of fuel poverty. The UK does have legally binding carbon reduction targets and the deployment of energy efficiency to reduce heat demand is widely seen as a requirement for decarbonisation.

3.1.2 A transformation rather than a transition

The word 'transition' is used frequently to describe energy system change in both the academic literature as well as in grey literature. For example, the UK Government used the term 'Low Carbon Transition' to describe progress towards a low-carbon energy system in the UK (DECC, 2009). Academic researchers have used to term 'transition' repeatedly to consider the development of increasingly sustainable socio-technical systems (STSs) (e.g. Shove and Walker (2010), Geels (2011), Lockwood (2013), Geels (2014) and Sgouridis and Csala (2014).

However, the term transition engenders the idea of subtle and managed primarily technical changes. For example, Stirling (2014, p13) explains that transitions are: '*mediated mainly through technological innovation implemented under structured control, presided over by incumbent interests according to tightly-disciplined knowledge, towards a particular known (presumptively shared) end*'. However, transformations are: '*…based more around wider innovations in social practices as well as technologies, driven by incommensurable, tacit and embodied knowledges, involving more diverse, emergent and unruly political re-alignments that challenge incumbent structures pursuing contending (even unknown) ends.*'

As described in chapter 1.2, the decarbonisation of the UK heat system requires rapid, technological and social change including changing business structures, the potential for stranded assets, the development of new industries and changes to energy consumer behaviour. As such, the slow and managed change suggested by the term 'transition' is not appropriate in the context of rapid and structural change. Therefore, this thesis uses the term 'transformation' to consider the required changes to the UK heat system.

3.2 UNDERSTANDING SUSTAINABLE CHANGE

While I use the term transformation in the case of the UK heat sector to highlight the need for rapid technological and social change, from the late 1990s, a rapidly growing research agenda around the changes of large unsustainable socio-technical systems to sustainable socio-technical systems has emerged which is often referred to 'sustainability transitions' (e.g. Smith *et al.*, (2010), Meadowcroft, (2011), Avelino and Wittmayer, (2016)) or 'socio-technical transitions' (to sustainability or similar) (e.g. Smith *et al.*, (2005), Geels, (2010) and Markard *et al.*, (2016)). I use the term 'sustainability transitions' throughout the rest of this thesis to describe this field of research but the term transformation will be used to describe the required UK heat sector changes.

Central to the concept of sustainability transitions is the idea that certain large systems can be considered as 'socio-technical regimes' where the interlinking of technology and socio-economic elements means that the system is dominant and rigid (Markard *et al.*, 2012, p956). Take for example the UK's automotive

system, it is formed of technical elements such as roads and cars but it also includes social elements, such as driving practices, the laws which regulate transport and the economics of the system. These elements all function seamlessly together to form something which is greater than the sum of its parts. Rip and Kemp (1998, p338) describe regimes as '*the rule-set or grammar embedded in a complex of engineering practices, production process technologies, product characteristics, skills and procedures, ways of handling relevant artefacts and persons, ways of defining problems—all of them embedded in institutions and infrastructures*.'

Socio-technical regimes develop over time and are seen to become increasingly networked and structured as technologies become socially normalised, learning takes place and economies of scale develop (Rip and Kemp, 1998). As a result of this integration, mature regimes are seen to have elements of irreversibility, lock-in and path dependency and become increasingly stable with innovation becoming increasingly rare (Berkhout *et al.*, 2003). The consequence of this increasing strength and stability is that as technologies become locked in, other technologies are locked out and struggle to compete even though better (for example more sustainable) solutions may exist (Berkhout, 2002).

This idea of sub-optimal technology lock-in builds on work by Arthur (1989) who explains that in an example where two technologies are competing, '*insignificant events*' (p116) can give one technology a temporary advantage; as a result that technology can gain an early advantage giving it increased deployment and therefore increased learning which allows it to win against the other technology and means it becomes locked it in. One widely used example of this lock-in is the QWERTY keyboard layout which was introduced to overcome a now eradicated technical issue with typewriters; QWERTY has now become a standard configuration but it is not believed to be the optimum keyboard layout for efficient typing[10] (David, 1985). Unruh's (2000) widely cited paper specifically considered this idea of path dependency from the perspective of carbon lock-in suggesting that existing locked in high carbon technologies

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[10] Discussions have taken place suggesting that the QWERTY configuration may actually be as good as potential alternatives (Liebowitz and Margolis, 1990) although the QWERTY example is still often used as a good example of path dependency.

systems (and associated institutions) are having the effect of locking out low carbon technologies.

This research considers the UK's current heat system as a socio-technical regime. This reflects a recognition of both the physical and social elements of the UK heat system as well as the need for it to (be) transform(ed) from an unsustainable system into a sustainable system. It also builds on the previous use of the concept of a socio-technical regime to consider the heat system in Sweden (Dzebo and Nykvist, 2017). Further still, there are few if any other approaches which consider the entirety of social and technological elements of large socio-technical systems.

A rapidly growing field of research into sustainability transitions considers how these complex and stable yet unsustainable socio-technical regimes can change into more sustainable systems. Markard et al. (2012, p957) provide a summary and analysis of the key work on the topic of sustainability transitions, suggesting that there are four key but linked research strands in sustainability transitions studies, these are '*transitions management*', '*strategic niche management*', '*the multi-level perspective*' and '*technological innovation systems*'. Genus and Coles (2008) however suggest that there are two key branches of research associated with sustainability transitions, '*systems in transition*' (primarily the so-called multi-level perspective) and '*transition management*' (p1436).

The concept of technological innovation systems is described as being *'focused on the development, diffusion and use of a particular technology'* (Bergek *et al.*, 2008, p408) whereas strategic niche management is described as the '*creation, development and controlled phase-out of protected spaces for the development and use of promising technologies by means of experimentation*' (Kemp *et al.*, 1998, p186). These descriptions imply a focus on specific technologies or innovations rather than the systemic or regime change I am interested in for this thesis. So-called 'transitions management' approaches (which are considered in a little more detail in upcoming section 3.3 because of their relationship to ideas of power) build on understandings from the multi-level perspective but represent a more '*avowedly interventionist, not fully analytical approach concerned with how to actively steer technological change*' (Genus and Coles, 2008, p1439). It appears then that while the approaches of 'technological innovation systems',

'strategic niche management' and 'transitions management' are related, none of them are suitable approaches to consider the entirety of the UK's heat system. The following section considers the potentially more useful multi-level approach in more detail.

3.2.1 The multi-level perspective

The multi-level perspective (MLP) is a theoretical model which attempts to describe how transitions of large socio-technical systems take place. The MLP can be traced back to analysis focusing on technological change in relation to that required to decarbonise energy systems (Rip and Kemp, 1998). Rip and Kemp (1998) suggested that large socio-technical systems have three layers which include the 'micro', where single artefacts or machines are developed, the 'meso' which considered regimes (or paradigms, considered previously in this chapter as socio-technical regimes) and the 'macro' level which considered the landscape in which the other levels sat. Rip and Kemp's (1998) model suggested that these three layers are interrelated and networked through social linkages to form seamless webs but did not use the term 'multi-level perspective' to describe the socio-technical system.

Building on the previous work, Geels and Kemp (2000) introduced a three layered model considering a '*multi-level perspective on innovations*' which similarly to Rip and Kemp's (1998) model had three layers, (micro (niche), meso (regimes) and macro (landscape). A sketch of this multi-level perspective is shown in Figure 3-1; this shows the three layers as vertically stacked with each layer linked to the others with the landscape layer forming the broad context, the regime layer representing the socio-technical regime of interest (formed of numerous interconnected elements) and the niche layer formed of a number of niches which have the potential to challenge and become the regime. Further analysis by Geels considering shipping specifically highlighted the interconnectedness of the three layers (Geels, (2002a).
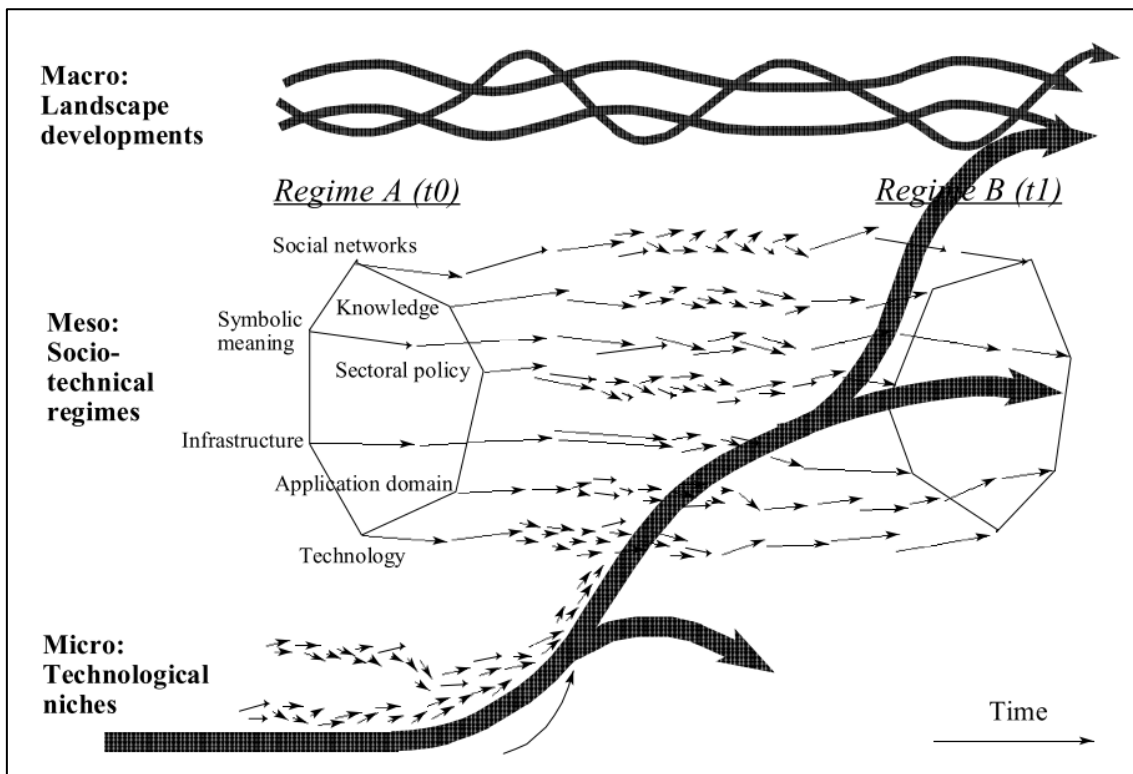
Figure 3-1. The dynamic multi-level perspective on transitions. From (Geels and Kemp, 2000, p22)

The multi-level perspective model was further updated in 2004 and included a specific recognition of users and user practices as well as the role of institutions and their part in structuring regimes (Geels, 2004). This 2004 article widened the '*unit of analysis from sectoral systems of innovation to socio-technical systems, encompassing the production, distribution and use of technology*' and also suggested that when transitions happen, socio-technical dynamics at all three levels *'link up and re-inforce each other*' (Geels, 2004, p915 and p916 respectively).

The MLP approach has been used to consider the transition from horse and carriage to automobiles (Geels, 2002b), changes in Swiss agriculture towards more organic and integrated approaches (Belz, 2004), the move toward sustainable transport (Nykvist and Whitmarsh, 2008) and low-carbon electricity scenarios (Hofman and Elzen, 2010) (as well as many other examples of transitions). These examples show the MLP approach has been used to consider both historic and potential future transitions and that across these examples, a combination of social, economic, environmental and technological factors interact.

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The MLP is not without critique. Among other things, the MLP has been accused of not paying due attention to the agency and power of actors and institutions which are seen to be an important element of promoting or constraining change (Smith *et al.*, 2005). Coming from a similar angle, the MLP has also been accused of being too descriptive and ignoring the politics which drives change (Shove and Walker, 2007). Shove and Walker (2010) continue their critique and suggest that a much better understanding of social practices and policy development would strengthen the MLP model.

Geels (2011) explains that throughout the course of the development of the MLP model it has received a number of sometimes valid criticisms including:

- A lack of focus on agency within the model;
- Difficulties with operationalising the model in particular how to delineate regimes;
- A bias towards bottom up models of change;
- That the model is of use only as a heuristic or explanatory tool;
- That it suffers from methodological issues including no clear analytical approach;
- That the landscape levels appears to be a residual category containing elements which simply don't fit neatly into other layers;
- That a hierarchical approach is not suitable for studying socio-technical systems because of their networked and systemic nature.

Recognising these criticisms, Geels (2011) responded to each of them and further updated the visual representation of the MLP to how it is shown in Figure 3-2. With regards to the suggested lack of agency in the MLP, Geels (2011) suggested that while elements of agency were actively considered, some elements including power struggles had not been but could be more thoroughly considered. This most recent visual representation showed much more clearly the connections between the different levels of the MLP and provided some explanations of system stability and potential locations for system change.
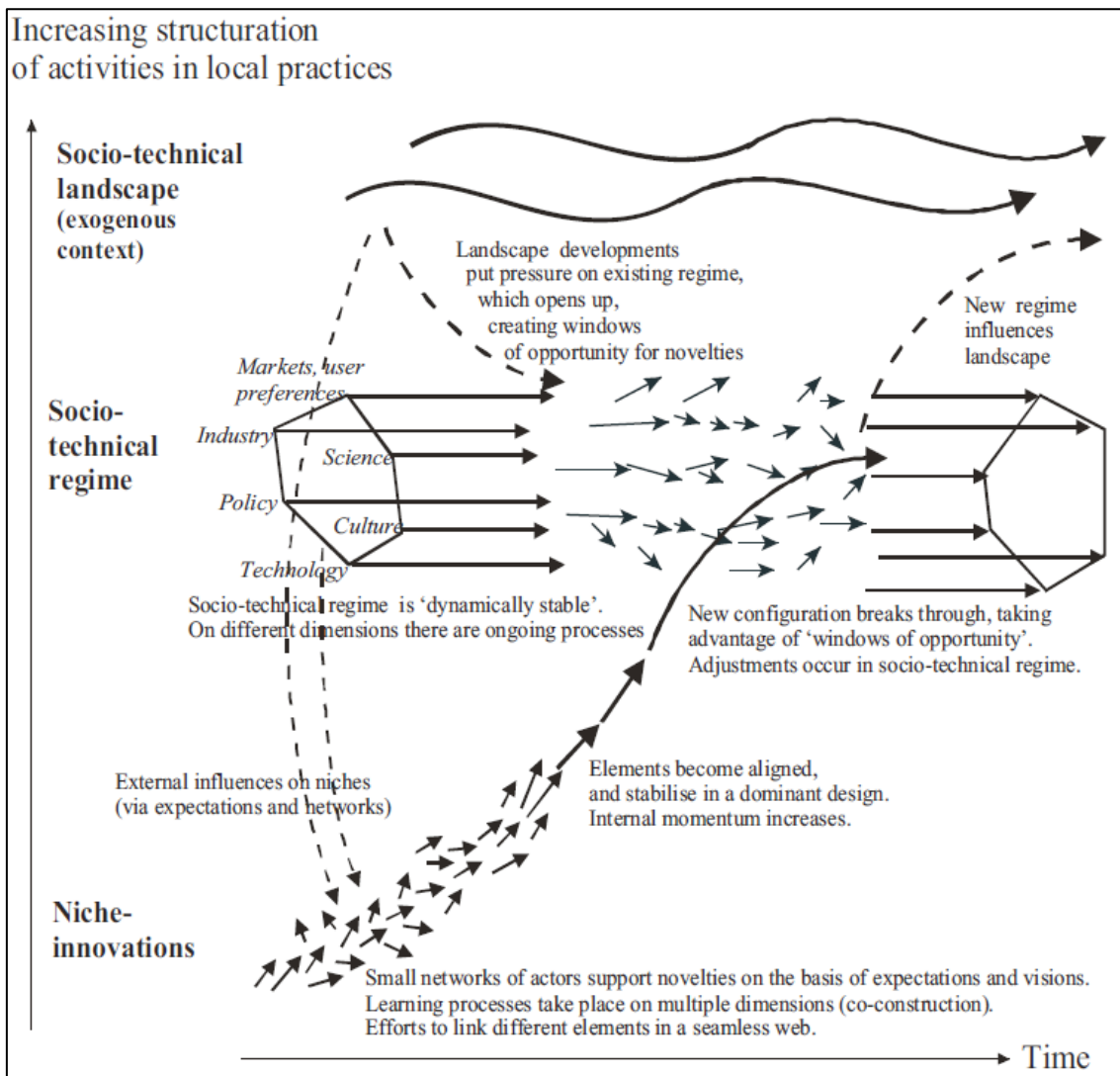
Figure 3-2. Multi-level perspective on transitions (Geels, 2011, p28)

Specifically with regard to agency and power issues, Geels (2011) recognises that while power has been indirectly included in approaches to the MLP, the theory could be '*theoretically enriched by mobilizing insights from other theories [including power]*' (Geels 2011, p30). Section 3.3 provides a much more in-depth review of discussions around power within the transitions literature.

3.2.2 Using the MLP to consider the UK's heat socio-technical system

There are a number of ways to consider energy system change from considering purely technical change to considering purely social change. However, the availability of tools to consider the combined social and technological elements of large systems is limited and the MLP offers an approach which can do just this. Therefore, for this thesis, the MLP is used as a tool to consider the UK's heat socio-technical system.

With the MLP as the framework to consider the system under study, the concept of power is the analytical focus of this thesis. In the following chapters I draw together ideas of power, policy development and transformation. I first, however, consider how the UK's heat system can be understood using the MLP and then investigate in more detail how power has been seen in relation to sustainable transformations.

3.2.2.1 The socio-technical landscape

This is the top level in the MLP. From a theoretical perspective, the landscape level has been recognised as being particularly difficult to define, described as '*a 'garbage can' concept that accounts for many kinds of contextual influences*' (Geels, 2011, p36). The landscape level is considered to be composed of exogenous factors which can remain stable, change suddenly or change slowly but which can put pressure on existing regimes and/or on niche-innovations which sit within the landscape. Geels (2002, p1260) suggests:

> *'The metaphor 'landscape' is chosen because of the literal connotation of relative 'hardness' and the material context of society, e.g. the material and spatial arrangements of cities, factories, highways, and electricity infrastructures. The socio-technical landscape contains a set of heterogeneous factors, such as oil prices, economic growth, wars, emigration, broad political coalitions, cultural and normative values, environmental problems. The landscape is an external structure or context for interactions of actors.'*

It is then the exogenous nature of the landscape level that is key. Thus the landscape can be understood as the exogenous context to the regime and

niche level, both of which sit within and are affected by pressures from the landscape level. However, while the landscape can be seen as the exogenous context, it is suggested that alongside other factors, the niche and regime levels of socio-technical systems can affect the landscape (Geels, 2011).

When considering the UK's heat system, the landscape level can be considered as the elements outside of the socio-technical regime and niche levels which can affect these levels such as environmental problems, macro-economic factors and particularly important when we are considering power, political coalitions and cultural and normative values. Delineating the landscape layer is challenging as it is not entirely clear where the landscape ends and the regime begins if they affect each other. However, a more precise delineation of the landscape is not necessary for the thesis.

3.2.2.2 The Socio-technical regime (STR)

This is the middle level of the MLP and represents the current and dominant social and technological aspects of systems. As shown in Figure 3-2, this level is formed of, among other things, markets, user preferences, policy, technology, industry, science and culture.

In the context of my research, the regime represents the existing system for providing space and hot water heating in the UK as described in chapter 1.2; primarily a gas based system with many of those not connected to the gas grid using electricity or oil for heat. The heat socio-technical regime therefore includes the companies present in the heat market and heat industry and their technologies as well as the heat consumers, consumer preferences and the cultural practices of consumers as well as the policy (which I take to include wider governance and regulation) which affects the heat system.

Section 3.2 explained that regimes are often considered to be relatively resistant to change because of the increasing integration of elements within them and the development of economies of scale as regimes grow. If a regime, or elements within one, can affect change, potentially blocking (a negative impact) or supporting change (a positive impact), this could clearly have implications for any transformation. Scholars have introduced ideas of regime resistance where actors have been seen to attempt to affect change in other socio-technical regimes (Geels, 2014) however it is not necessarily the case

that regimes may slow change with examples of regime actors also driving sustainable change (Stenzel and Frenzel, 2008).

Other research by this author has investigated the recent activities of incumbents (regime actors) in the UK heat sector. That research has shown that incumbents have attempted to affect the move to sustainable heating by using lobbying and directed innovation to promote technologies which support their own interests (Lowes *et al.*, 2018b). This thesis considers the period before the author's work on incumbency and its focus is wider than purely 'incumbents', focusing across the wider heat system, also taking into account activity at the niche layer.

3.2.2.3 *Niche-innovations*

This is the lowest level in the MLP model and represents actors and networks developing novel technologies and practices which may develop to challenge the regime by displacing regime technologies or practices. In niches, radical innovations can be generated for technologies which are currently expensive and unreliable (Geels, 2002a). When considering the UK heat system, the niche-innovation represents novel and more sustainable technologies and practices for generating, using and supplying heat including those identified in chapter 1.2 which appear to be important for the UK to reach its carbon reduction goals.

3.3 POWER WITHIN THE TRANSITIONS LITERATURE

This section builds on section 3.2 which introduced the concept of sustainability transitions and introduced the MLP model. The previous section highlighted some critiques of the MLP and a number of these suggested that there is a lack of focus on power within the theory. This section expands on the issue of power and sustainability transitions and contains the most in-depth and up-to-date review of considerations of and research into the concept of power within the sustainability transitions debates.

The review is generally presented chronologically in order to show how ideas around power have developed in this field. While the MLP model is being used within this thesis, the following section also considers discussions of power linked to transitions management approaches (briefly mentioned previously).

Transitions management is a concept which utilises the MLP model (Rotmans *et al.*, 2001) but offers an '*avowedly interventionist*' approach to sustainability transitions (Genus and Coles, 2008, p1439). It has been summarised as an approach that employs:

- '*Long-term thinking (at least 25 years) as a framework for shaping short-term policy*
- *Thinking in terms of more than one domain (multi-domain) and different actors (multi-actor) at different scale levels (multi-level)*
- *A focus on learning and a special learning philosophy (learning-by-doing and doing- by-learning)*
- *Trying to bring about system innovation alongside system improvement*
- *Keeping a large number of options option (wide playing field).*'

(Rotmans *et al.*, 2001, p22)

Collaborative working to develop long term goals, developing long-term visions, setting shorter term objectives and continually evaluating and learning from previous experiences is also central to transitions management approaches (Rotmans *et al.*, 2001). Kemp and Loorbach (2006, p111) add that '*transition arenas and multi actor governance*' are important aspects of transitions management approaches. These arenas are discussion forums for actors with an interest in the transition under focus and there is a suggestion that these arenas represent new institutions for actors to develop interaction, exchange knowledge and also develop visions of the future collaboratively.

As a result of the closeness of the MLP and transitions management concepts, it is expected that understandings from critiques of transitions management may also be applicable to the MLP framework.

3.3.1 Early considerations of power within sustainability transition debates

Smith et al. (2005) considered the power of the regimes linked to Dutch transitions management approaches. They argued that because of the concepts of regime strength and stability, the role of incumbent regime actors and the credibility that existing players had to shape visions, a much greater understanding of the agency of actors to shape the governance of system

transformations was required. Conversely, Smith et al. (2005) also recognised that a regime could constrain regime actors' attempts to make changes as a regime may have the power to limit the agency of actors.

The ability of regimes to affect Dutch transition approaches was also recognised by transition management proponents. Kemp *et al.*, (2007) explain that while transitions management approaches have become '*one of [the Dutch government's] pillars to achieve a sustainable energy supply*' (Kemp *et al.*, 2007, p321). However, established players had played too large in role in the processes so far as '*the transition paths have been chosen by people in the platforms (in which the business voice is prominent*' (Kemp *et al.*, 2007, p327). Kern and Smith (2008) repeat the suggestion that Dutch transition management has been captured by regime actors who have steered discussions in a direction which suits them. Others researching Dutch transition policy for agriculture suggested that actors were primarily interests in protecting themselves and this was a particular issue because of the open and reflective nature of transitions approaches (Hendriks & Grin 2007).

Again, focusing on transition management approaches, Shove & Walker (2007, p764) explain that '*studies of systems in transition are typically distanced, even voyeuristic making few claims about how individuals can, might, or even should act to affect the processes in question*' (p764). They go on to explain that these approaches can '*all too easily obscure their own politics, smoothing over conflict and equality*' (p768) and like Smith et al. (2005) recognised that regime actors have the ability to shape visions and understandings of transformations; they called for a far greater recognition of the agency of and politics associated with transitions.

Smith & Stirling (2007), once again with regard to transition management, explained that power relations and established structures can limit visions and affect constructions of transitions toward sustainability and even the notion of 'sustainability' is affected by power; they suggest that in order to open up debates and reveal these often hidden political aspects '…*we need to move from a view of 'steering as management' to 'steering as politics*' (p369). With a similar focus, Walker & Shove (2007) argue that while reflexive governance approaches such as those used within transition management bring issues into

the open, these approaches may frame discussions in a way which naturally excludes certain actors thereby obscuring the associated politics.

In response to Shove & Walker's (2007) critique, Rotmans & Kemp (2008), leaders in the transition management approach suggest (without going into any detail or explaining how) that within transitions management '*power is distributed over various actors, with different beliefs, interests and resources*' (p1007) and argue that over the course of transitions, the fact that there will be winners and losers is simply '*accepted by business*' (p1008). However, Kern & Smith's (2008) analysis of transition management approaches by the Dutch Government's Department of Economic Affairs discovered significant 'capture' of the approach by incumbent energy industry actors. These actors dominated the so called transition arenas and the overall transition task force was led by the chief executive of Shell, a firm with major fossil fuel interests in the Netherlands. This caused serious legitimacy issues for the overall transition project (due to the perception that Shell wanted to shape the project around its own interests) and highlighted the role that power can play. Recognising previous critiques around a lack of focus on agency, Genus & Coles (2008) explain that in order to test and strengthen the MLP, there are significant opportunities for analysing how actors, including the state and other interested actors affect the diffusion of technologies through society.

Overall, even relatively early on in the development of approaches to sustainability transitions, power was seen to not be fully considered or explored. In particular, it was argued that greater attention should be paid to the agency of regime actors to shape future visions. A much greater understanding of the politics associated with the regime was also seen to be necessary.

3.3.2 Increasing recognition of the importance of power

In 2009, the Policy Sciences journal released a special edition focusing on 'designing long term policy' which contained articles primarily interested in transition management, mostly in the Dutch context. In their synthesis article for the special issue, Voß *et al.*, (2009) explain that while transitions management approaches may be a useful framework for long-term policy design, these approaches will always be embedded within broader political contexts and policy and politics are some of the most unresolved issues with transitions

management. Within this special edition, Hendriks (2009) focused (like previous researchers) on the power associated with the Dutch energy transition project and explained that despite the potential value of transition management approaches, the important and immovable politics (particularly associated with regime actors) was widely being ignored.

Many of these issues were also considered in the same special issue by Meadowcroft (2009) who highlighted the lack of external actors present in transitions processes and noted the dominance of regime actors with their own interests aiming to affect transitions. He explained that '*to the extent that societal actors become engaged in transition activities, and think more clearly about the future evolution of the systems with which they are involved, they are bound to be concerned with their own place in future arrangements. In other words, acute social and political struggles about the character of these transitions seem inevitable*' (p328). However, perhaps Meadowcroft's (2009) key critique of transitions management concerns a lack of consideration of who is actually able to drive transitions and a lack of focus on the importance of policy and regulatory change.

In the same special issue, considering transition management approaches, Avelino (2009) considered the dis-empowerment that small and non-regime actors may feel when taking part in transition workshops associated with unfamiliar topics or language and engaging with large and often experienced regime actors; this highlighted a potential lack of power for new entrants and niche players and a power asymmetry between regime and niche actors.

Moving the discussion further, Avelino & Rotmans (2009), in recognising the importance of power within the MLP framework and in particular the importance of power in slowing system change, suggested five different types of power within transitions can be distinguished:

- Innovative power where actors through working together can create or discover new resources;
- Destructive power, where actors have the ability to destroy resources such as natural resources, infrastructure, people or animals;
- Constitutive power, linked to ideas of structural power is the ability to establish, institute or enact a distribution of resources;

- Transformative power is the ability to transform the distribution of resources;
- Systemic power is the combined capacity of actors to mobilise resources for the survival of a societal system.

While the work of Avelino & Rotmans (2009) provides an interesting interpretation of the potential types of power associated with sustainability transitions, it is unclear how the researchers reached the conclusions they did from their analysis. The types of power they describe have not been synthesised from existing literature or been developed from novel analysis. The ideas proposed above also appear relatively abstract and it is not clear how they could be applied to real life examples of transitions. Attempting to take this work forward and based on the five types of power considered previously, Avelino & Rotmans (2011) attempted to develop a framework to conceptualise power for sustainability research in general (as opposed to transitions) however, it's applicability to real word challenges appears questionable as there is no clear methodology but rather a number of complex ideas describing the types of power (as in the 2009 article) and a suggestion that in real life power relations are made up of:

- The power of actors over other actors;
- Some actors having more power than other actors;
- Actors having different types of power.

The focus on sustainability in general and the lack of an obvious methodology means that the Avelino & Rotmans (2011) framework while of theoretical interest appears of only limited value for this thesis.

3.3.3 A greater focus on power within the MLP

Building on certain criticisms of the MLP model with regard to its limited social focus, and specifically with regards to power, Geels (2010) suggests that '*The MLP…can perhaps be enriched with further crossovers to power theories*' (p508). This was primarily because change in systems is unlikely to occur if incumbent actors are able to maintain their existing power and block innovation. Within the same article Geels (2010) explains that while in his view the MLP does include some understandings of power, the model could benefit from '*richer, multi-faceted views of power and conflict*' (p506), one example being

Lukes' '3 faces of power' model (which is considered in more detail in upcoming chapter 4). Geels (2010) describes the three faces of power as:

> *'the first being the use of political power and authority in formal decision-making arenas. The second relates to the power to place issues on or keep them off the agenda (backroom deals, lobbying, implicit threats). The third is about influencing the preferences of subordinate groups so that they do not feel the urge to place issues on the agenda' (p506).*

In a general review of the MLP approach, Smith et al. (2010) suggest that as well as considering power in general, MLP approaches would benefit from '*opening the black-box of public policy*' because policies can affect socio-technical change through funding for innovation, incentives, regulations and the provision of platforms for promoting niches. Smith et al. (2010) go on to explain that '*there are long-standing literatures on regulatory capture, government-industry relations, clientelism, iron triangles, policy networks, and discourse coalitions that can help us ensure analysis of socio-technical regimes and public policies are more deeply intertwined*' (p446).

Shove & Walker (2010) consider socio-technical transitions from the perspective of social practices and propose a very different idea of power, not purely associated with policy. Linked to the approaches of among others, Michel Foucault (introduced in detail in section 4.1.5.1), they suggest power in socio-technical systems can be '*invisibly woven into the design of arrays of materials and services like those which constitute regimes of family life*' (p475) highlighting the potential importance of more dispersed, structural and less purposive forms of power.

At a similar time, Grin (2010) considered the role of power associated with the governance of transition management approaches, recognising the importance of reflexivity and legitimacy within transition management. Like others, Grin (2010) suggests that many innovative solutions to sustainability issues run into problems associated with incumbent regime actors but Grin introduced a model which considered power in the three layers of the MLP based on previous work by researchers focusing on power and policy (Arts and Tatenhove, 2005). This

model is shown in Figure 3-3 and suggests there are three different types of power acting across the MLP:

1. Relational power linked to the behaviours of actors to actively have power;
2. Dispositional power associated with the positioning of actors in privileged positions;
3. Structural power associated with long term landscape trends.

Type of power	Focus	Level in MLP
Relational (transitive and intransitive)	Power in the form of the means (e.g. money, knowledge, social capital) on which actors may draw in their (innovative) practices), co-determining the outcomes of their interactions with other actors	Practices
Dispositional	Positioning of actors in a regime (comprising rules, resources, actor configurations, and dominant images of the issue involved) privileges particular practices and discourages/ complicates others	Regime
Structural	Long-term socio-historical trends, such as liberalization, Europeanization, and the emergence of information society. This results in pressures on practices and regimes, changing the power implied at these levels	Slowly changing landscape

Figure 3-3. Three layers of power (Grin 2010, p283)

The framework in Figure 3-3 has since been used in an attempt to analyse wind energy developments in Denmark and while seen to have value, a number of shortcomings in the framework were identified. In particular, the framework did not represent the development of novel social practices and how these affect and are affected by the other layers of socio-technical systems (Hoffman, 2013).

Focusing on power as politics, Meadowcroft (2011) explains that '*sustainability transitions are inherently political*' (p71) and argues that because of this, a much greater focus by researchers on the politics of transitions focusing on interests, ideas and institutions and using insights from previous political experience would strengthen understandings of sustainability transitions.

In a response to a number of criticisms regarding the MLP, Geels again recognises the importance that agency, power relations and political lobbying can have within socio-technical systems and in particular the role these aspects can have in stabilising regimes and slowing change (Geels, 2011). Geels (2011)

goes on to suggest that '*the MLP can be theoretically enriched by mobilizing insights from other theories*' (p30) associated with agency and power.

While much of the previous literature has suggested that power may be an important element of transitions, Kern (2011) actually investigated elements of power within sustainability transitions. He considered the roles of ideas, institutions and interests in two energy transition policy initiatives, the Dutch energy transition project and the UK 'Carbon Trust'. Kern identified the important role that discourses and institutional structures played in causing the policy variance between the two initiatives with both existing interests and existing institutional factors affecting policy outcomes. In further research into the Carbon Trust which didn't focus specifically on power but instead used the MLP as a tool to assess innovation policy, Kern (2012) recognised that the Carbon Trust was inadvertently supporting powerful groups such as financiers and corporations to be involved in energy innovation but not taking account of other societal actors; it was explained that this was as a result of its institutional pro-business focus and led to non-neutral technology policy choices by the Carbon Trust.

In other UK based research, historical document based analysis of UK gas sector governance considered the role of various actors within the gas regime suggesting that both of the cases considered, '*show[ed] the significance of actors having the power not only to take decisions, set policy regimes and plans but also the coercive power to align actors along specific pathways*' (Arapostathis et al. 2013, p42). However, within this research, the authors did not define power or their methodology for measuring it, even though understanding it formed a central part of their analysis.

3.3.4 Applying political science approaches to transitions

Following discussions around the importance of power and transitions and calls for research, more recently researchers have considered sustainability transitions using political science/policy analysis approaches.

Kuzemko (2013b) considers the applicability of new institutional approaches, which consider the role of ideas, social construction and policy paradigms, to understand socio-technical change and explains that there is a much greater role for analysis using these approaches. These approaches were expanded

further by Kuzemko et al. (2016) who developed a framework for considering the various elements which can affect the governance of sustainable energy system change; this drew on insights from institutional approaches, policy change, practice based research and socio-technical transitions. Latterly, Lockwood et al. (2017) also recognised the approach of institutions with regard to energy transitions but specifically noted the role of 'historical institutionalism' approaches where the development of institutions over time and their impact on governance and policy is considered. One example Lockwood considers is the development of energy industry network codes and the role of incumbents in being able to control them as a result of their institutionally set position on the panels which control changes to codes; this work highlighted concerns around the dominance of regime actors.

Focusing again on institutions, Fuenfschilling & Truffer (2014) considered urban water systems in Australia, recognising the potential role of institutions as a form of power within socio-technical systems to drive approaches to governance.

In a notably significant intervention in the debate regarding power and transitions, Geels (2014) focused specifically on the idea of 'regime resistance' and the ability of regime actors to slow transitions with their power. Geels (2014) summarises the main previous attempts to consider power in sustainability transitions studies as shown in Figure 3-4. He suggests that there appear to be three key distinctions of power which share similar characteristics but are generally referred to differently. The top level considers what are referred to as material, instrumental, relational or interest based elements of power. The middle level appears more related to the power of ideas or discourse and the bottom level is associated with more structural, institutional or organisational power. One suggested distinction highlighted in Figure 3-4 (from Kern, 2011) is between 'interests', 'ideas' and 'institutions' and chapter 5 which considers power, politics and policy change is based around these elements.

Levy and Newell (2002)	Avelino and Rotmans (2009)	Grin (2010)	Kern (2011)
Material	Instrumental	Relational (immediate interactions between actors)	Interests
Discursive	Discursive	Dispositional (related to rules, resources, actor configurations and dominant images)	Ideas (discourse)
Organizational	Structuralist (material and institutional)	Structural (related to wider orders of signification, domination and legitimization)	Institutions

Figure 3-4. Various distinctions of power[11] (Geels, 2014)

While Geels (2014) suggests that there should be a much greater focus by researchers on regime power and Geels explains how regimes *may* have had power with regards to the UK's electricity system, Geels does not show that these regimes actually *did* have any power. Neither does Geels provide a thorough or complete conceptualisation of what power actually is.

Hess (2014), like Geels (2014) also suggested that analysis of incumbent regimes should be at the centre of analysis of sustainability transitions and Hess (2014) specifically investigated the financing of renewable energy political campaigns within US politics. The analysis by Hess (2014) suggested that because of the relationship between financial contributions and vote successes, the financial contributions of actors may be a way that actors can have power in the US policy process.

A 2016 special edition in the The Journal of Environmental Policy and Planning focused on the politics of transition suggested that power was spread across socio-technical systems (Avelino *et al.*, 2016). The authors went on to explain that while power was not necessarily only present at the regime level, vested interests often did have the ability to capture transition processes because visions are produced by regime actors and thus reflect the status quo (Avelino

[11] It should be noted that the distinctions of power in this table do not align with the description of Avelino and Rotmans' (2009) types of power explored in detail in section 3.3.2 suggesting discrepancies between understandings of power in transitions debates.

et al., 2016). Within the special issue, authors considered the institutional lock-in effects of electricity system governance (Castán Broto, 2015), representation and the lack of representation in transition management approaches (Kenis *et al.*, 2016), the role of incumbents in capturing and controlling the direction of innovation in relation to Dutch traffic management policy (Pel, 2015) and the importance of ideas and visioning in energy scenarios (Gaede & Meadowcroft, 2016).

In the same special issue, Avelino & Wittmayer (2016) suggest that '*the regime is by definition associated with 'power', 'dominance' and 'vested interests'* (p631). It is clear however that Avelino & Wittmayer (2016) take a normatively negative approach to the existing power in regimes asserting that the energy transition is '*also a socio-political transition from centralised for-profit energy companies, to decentralised, not-for-profit community based and/or Third Sector-based energy cooperatives*'(p368) implying the niches must somehow overtake the regime actors who are unable to change. This thesis doesn't necessarily view incumbents and regime actors as a force of resistance and instead looks to investigate power within the UK's heat system taking an explorative approach. This reflects the limited investigation into the UK's heat sector and the diversity of actors within it, who each may take their own approach towards a sustainable heat transformation.

Separate from the special issue, Raven et al. (2016) suggest that transition frameworks would benefit from an understanding of how protective spaces and policies for niche technologies develop in the first place, focusing on the role of policy advocates. In a more applied investigation into transitions and policy change and also considering advocacy, Markard et al. (2016) analysed energy related consultation responses in Switzerland and showed that there were two broad coalitions of actors, a '*pro-economy*' conservative coalition formed primarily of incumbent businesses operating in the energy system and a more diverse '*pro-ecology*' coalition more interested in green energy transition. However, whilst interesting in exploring the coalition, the research actually says nothing about actual policy change resulting from the coalitions.

3.3.5 Synthesising ideas of power within the transitions literature

There is a growing literature associated with sustainability transitions considering elements of power. However, there is no general or agreed theory in the transitions literature of what power is and why it is important and understandings of power are broad and disparate.

A few themes have however emerged. Some authors have recognised the importance of the agency of actors to cause change when considering transitions (Smith *et al.*, 2005; Shove and Walker, 2007) whereas social structure has also been recognised for its importance (Smith *et al.*, 2005; Geels, 2010). There has been a major recognition of the importance of the power of incumbents and actors currently involved with existing regimes (Smith *et al.*, 2005; Kemp *et al.*, 2007; Meadowcroft, 2009; Grin, 2010; Geels, 2011; Geels, 2014; Hess, 2014; Pel, 2015; Avelino and Wittmayer, 2016). Closely related to these issues around incumbency is the suggestion that the main form of power associated with sustainability transitions is linked to the capture of transitions by incumbents (Kern and Smith, 2008) and self-interest (Hendriks and Grin, 2007; Meadowcroft, 2009).

Small and niche actors have also been recognised as having some power from outside the regime (Späth and Rohracher, 2010) yet there has also been a recognition that niche actors may be unable to participate due to a lack of access or technical understanding (Avelino, 2009; Kenis *et al.*, 2016).

There has also been a recognition of the importance of the more discursive aspects of power with actors able to shape language, visions and ideas of transitions (Späth and Rohracher, 2010; Smith and Stirling, 2007; Walker and Shove, 2007). Actors may therefore have the potential to shape what a sustainability transition looks like before it has even started by, for example, determining goals or approaches.

Wider power concepts such as legitimacy (Grin, 2010) and leadership (Meadowcroft, 2009) have also been recognised as important. And the literature has specifically recognised the importance of politics (Meadowcroft, 2011; Kuzemko, 2013d) and policy (Hendriks, 2009; Meadowcroft, 2009; Raven *et al.*, 2016) associated with transitions.

Yet while the literature has recognised the potential importance of power in transitions, there has been more limited research into the actual role of power in affecting transitions. As described in the previous sections, researchers have:

- Considered the development of local discourses becoming institutionalised at regional levels (Späth and Rohracher, 2010);
- Seen the dominance of transition arenas by incumbents (Kern and Smith, 2008);
- Considered the creation of novel practices in wind energy in Denmark (Hoffman, 2013);
- Considered the role of ideas, interests and institutions (Kern, 2011);
- Recognised the involvement of certain groups (Kern, 2012);
- Hypothesised about historic regime power (Arapostathis *et al.*, 2013);
- Investigated the dominance of certain industry codes by incumbents (Lockwood *et al.*, 2017);
- Considered the power of institutions in driving change in water systems (Fuenfschilling and Truffer, 2014);
- Considered the role of political paradigms (Castán Broto, 2015);
- Analysed the development of energy scenarios (Gaede and Meadowcroft, 2016);
- Considered energy technology advocacy (Raven *et al.*, 2016);
- Analysed policy coalitions using consultation responses (Markard *et al.*, 2016).

This previously identified research which has considered the role of power associated with sustainability transitions represents an important theoretical contribution to debates associated with transitions. However, the literature is still relatively limited in scale and says little about how power has actually caused real world impacts. There is therefore scope for a much greater understanding of power associated with sustainability transitions and room for further investigation into its impacts on real world change.

As well as suggesting that a much greater general focus on power is needed in the transitions literature (Geels, 2010; Geels, 2011), researchers interested in power and transitions have also called for a specific focus on how actors can affect technology diffusion (Genus and Coles, 2008), a greater focus on power

and public policy (Smith *et al.*, 2010), a focus on ideas, interests and institutions (Meadowcroft, 2011), a greater focus more specifically on new (Kuzemko *et al.*, 2016) and historical (Lockwood *et al.*, 2017) institutional approaches as well as the application of more general power theories such as the 'three faces of power approach' (Geels, 2010).

3.4 CHAPTER SUMMARY

This chapter has introduced concept of sustainable transitions. This approach has been used to consider how large socio-technical systems change from being unsustainable to becoming more sustainable. The chapter suggested that a sustainable UK heat system would be low carbon, secure and socially equitable and that to consider the changes required for the UK's heat system, because of the scale and speed of changes required, the term transformation was more appropriate than transition.

The multi-level perspective was highlighted as a key approach for understanding sustainable change within large systems and its ability to focus on the breadth of entire socio-technical systems suggests it may be suitable to consider the UK heat system. However, while the MLP approach may be a valuable framework, it is an approach which has been critiqued for not paying enough attention to ideas of agency and power. Ideas of the power of incumbents and political power have been suggested to be potentially interesting and valuable areas for research. While there has been some research and analysis considering ideas of sustainable transitions and power, the literature is still fairly limited.

This thesis adds to the literature on power and transformation. It uses the multi-level perspective as a primarily descriptive model to consider the UK's current heat system and investigates power within political elements of this system. Building on this chapter, to further support the theoretical underpinning of this thesis, the following chapter explores how the contested concept of power has been considered by scholars.

4 UNDERSTANDINGS OF POWER

The concept of power is central to this thesis but the specific focus of the thesis is on the power of actors such as companies, trade associations and policy makers, to influence policy and governance associated with the UK's transformation to low-carbon heating. Taking a wide conceptual view to start with, this chapter considers theoretical approaches to the general concept of power, a topic which appears unbounded and has been studied in various disciplines including sociology, philosophy and political science.

At this point, a reader may be thinking: 'but what is power?' or 'how is it defined?'. These are valid and important questions. However these are questions which are extremely difficult to answer in any sort of a complete way. Power has been seen as '*essentially contested*' (Lukes, 1974, p9) which implies that it has similar definition problems to things such as art, democracy or legitimacy which all have '*continual disagreement concerning their essence*' (Haugaard and Ryan, 2012a p10). As well as being essentially contested, power has also been described as a '*family resemblance concept*' (Haugaard 2010 p419) due to the large number of different approaches to power (i.e. the family relations) but with a recognition that there are similarities and differences between the members of the family.

This chapter outlines some of the key contemporary approaches to understanding power and power relations and describes how these understandings have come to be. While the key approaches to consider power and the associated authors are explored, there is a vast literature associated with the concept which no scholar could ever completely review. This scale issue is compounded by the interaction of power studies with other elements of the social sciences such as economics[12], psychology, sociology and political science.

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[12] The idea of 'economic power' is a related but more specific power issue which '*can be broadly defined as the ability to control or influence the behaviours others through the deliberate and motivated use of economic assets*' and this could be at a nation state or business level (Frost, 2009, p9). Marxist economists see economic and political power as being closely related (Strange, 1975). Greater economic assets can create a greater ability to attempt to influence

As far as is possible, this section is written chronologically explaining how approaches to power have emerged or developed over time. The development of thinking around power has evolved in such a way that rather than there being one unifying theory, power has become a group of related concepts. However, attempts have been made to combine approaches to power. At the end of this section I introduce a theoretical approach which attempts to blend the key understandings of power into one overarching framework called 'Four Faces of Power'. This approach is then used throughout the thesis as the key theoretical approach to the essentially contested, family resemblance concept of power. An ongoing recognition of the important differences and connections between 'agent' based and more 'structural' forms of power is also considered throughout the thesis.

Defining power is clearly complicated and according to one scholar it '*seems as if any student of power designs his or her approach*' (Arts, 2000, p112). So, rather than defining power in a broad way which is beyond the scope of this thesis anyway, I now define my interest in power for the purpose of this thesis:

Specifically, this thesis is interested in how actors have affected elements of UK policy and governance associated with heating in a way which could support or slow the transformation towards a more sustainable heat system. *Power in this thesis is seen as the ability of actors to affect policy and governance associated with the decarbonisation of heat.* This understanding suggests that in order to have had power, actors must have been able to affect policy and governance and this reflects the focus within the thesis on purposive attempts by actors to have power. While examples of when actors have had power is of central interest, the thesis also considers the approaches that UK heat market actors may use to attempt to have power to affect policy change even though they may not have been successful.

4.1 THE DEVELOPMENT OF POWER STUDIES

Despite being a '*core concept*' within social sciences, power '*…is arguably one of the most difficult concepts to make sense of*' (Clegg and Haugaard, 2009,

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(Salamon and Siegfried, 1977) linking to ideas of 'capacity' to have power which are considered throughout the thesis.

p1). It is suggested that power remains one of the most contested issues in the social sciences (Arts, 2000).

As described previously, even descriptions of the concept vary widely with Lukes (1974, p9) describing power as '*essentially contested*'; more recently, Lukes (2005) explained that '*there is no agreement about how to define it, how to conceive it, how to study it and, if it can be measured, how to measure it*' (p61).

Haugaard (2012) gives a historical overview of the development of thinking around power in the social sciences. He explains that within modern social science, the concept of power has moved from more simplistic concepts such as motivations to vote in particular ways and the control of particular issues on and off the agenda to more complex understandings of power around knowledge, truth, institutions and ideas.

Across approaches to power (which include understandings from the disciplines of sociology, philosophy and political science), many authors agree that as the theory has developed over time, a rough framework to consider power has emerged. This understanding sees a relatively chronological development of different and additional ways to conceptualise power, often described in the literature as different faces or dimensions of power[13] (e.g. Clegg, (1989), Haugaard & Ryan (2012), Lukes, (2005) and Sadan, (1997)). This implies that there is at least some consistency around understandings of the development of power theoretically, even if authors disagree on the actual theories.

It should be noted that as new understandings of power have developed, rather than one theory replacing another, the process has been additional with the theory becoming generally wider and more complex over time.

4.1.1 Early approaches to power

Machiavelli's 'The Prince' written in the 16th century represents some of the earliest writing on power and is seen as a 'classic' in the field (Sadan, 1997, p33). In 'The Prince', Machiavelli, suggests that in order to maintain power, politicians and leaders must separate morality and politics implying that in order

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[13] The term 'faces' is used rather than 'dimensions' within this thesis although this is purely for simplicity rather than any particular preference or for semantic reason.

to be effective, politicians and leaders do not need to act ethically or honestly (Machiavelli, 1999). Power is seen as a means by which individuals can seek strategic advantages in order to reach their own goals (or interests, an idea considered in more detail in section 5.3) (Sadan, 1997), this suggests Machiavelli was more interests in agent based power of actors. Machiavellian thinking implies that those with power could employ a dishonest and fabricated image using deceitful methods to rule and control, and while being written centuries ago, this is an approach which it has been argued reflects corporate marketing and lobbying in the UK (Harris and Lock, 1996). This could be seen as a conflictual or domination linked approach to power, something which is sometimes described as 'power over' where one actor has power over another.

The other historical 'classic' in the field of power is Hobbes' Leviathan published in 1651. Leviathan is interested in the role of the legitimacy and authority of leaders (monarchs) in leading and organising society; it sees individuals as primarily self-interested elements of society who require the authority of a legitimate leader to maintain social stability (Hobbes, 1996). This approach is clearly quite different from Machiavelli's, and power to Hobbes while being linked to the power of the monarch *over* society, also implies an element of social contract between the monarch and individuals; this suggests that the individuals are part of a two way power relationship rather than being purely dominated and could be seen as a more structural approach to power.

4.1.2 Initial modernist understandings of power

Despite what many would now consider the centrality of power to social (and political) sciences, it was not until after the second world war that the concept of power became an important specific theme (Sadan, 1997). The literature on power rapidly expands from the 1960s.

Hay (2002) explains that in the early days of this new era of power studies, power theorists initially considered power simply as the power of actors over other actors; often referred to in the literature, the power of actor A over actor B. Like Machiavellian approaches, this could be considered as a more 'conflictual' approach to power (as was discussed earlier in section 4.1). This approach to understanding power has since become described by some as the first face of power (Lukes, 1974, Hay, 2002 and Haugaard, 2012). Quite simply in this

approach to understanding power, an actor (A) is able to get another actor (B) to do something that would have not happened without the presence or behaviour of actor A. This view which represents a conflictual view of power linked to ideas of domination, generally sees elites and leaders as the individuals who have power over the population. Box 1 below contains a heat related theoretical example of the first face of power.

Box 1. Example – The First Face of Power

A theoretical example of the first face of power linked to UK heat decarbonisation policy is described below:

Press release: 'Flame-heat, the UK's leading manufacturer of oil boilers has forced the Government to cancel its subsidy for electric heat pumps which were expected to replace oil boilers in off gas grid areas. Flame-heat demanded that the Government removes the subsidy and if it didn't, it would be forced to shut its factory in Manchester and make 500 employees redundant. Thankfully, those jobs are now protected.'

This theoretical example shows how Flame-heat has power over the Government and how the first face of power could work in practice. Flame-heat's behaviour caused the Government to change their policy for heat pumps. However, this example also shows that Flame-heat has power only because they threatened job losses and that power is linked to the position and situational factors of Flame-heat rather than just because they are powerful *per se.*

It should also be noted (and these issues are expanded in section 7.4) that just because the company says it may have been successful, the actual policy change could have happened for other reasons or only in part due to the efforts of Flame-heat.

Robert Dahl is considered as one of the key modernist theorists on power (Haugaard, 2012a) and Dahl's study 'Who Governs' on the politics of New Haven, Connecticut, is considered as a key piece of work and is widely referenced and discussed across the power literature. In this study, Dahl looked

at the development of politics and voting preferences in New Haven policy making. The research concluded that previous views which has suggested that New Haven was governed by an elite group was in fact not correct but that in reality, New Haven was governed by a wider plurality of actors representing a wide range of different actors (Dahl, 1961).

In showing that power was diffuse beyond the elite and was not solely linked to domination, the Dahl work represented a major advance and a first step into more sophisticated modernist understandings of power; it showed that simple ideas of the first face of power may not show the whole picture in real world situations. However, despite the wide impact of the Dahl work, even in 1989, Clegg (1989) suggests that the approach to power which considers the agency of actors to have power over other actors, i.e. the first face of power, is still the most pervasive view of power. Indeed, in recent examples of research considering sustainable change and energy system change, normative assumptions are made around the ability of elite corporate actors to dominate policy arenas (e.g. Dutch Energy Transition Arenas (Kern and Howlett, 2009) and fossil fuel interests in the UK policy space (Geels, 2014)). This is not to say that the dominating power of large corporates over the policy process is not an issue worthy of investigation. However, the focus of previous research on this implies less of a focus elsewhere, for example on the ability of individuals from the bottom up to have power or on the power within political systems. Clearly the first face does not offer a complete view of power.

4.1.3 Setting the agenda, the second face of power

Although the first face understanding of power is recognised as being a real and relatively easy to understand and potentially measure aspect of power, theorists (such as Dahl) saw it as over simplistic and relying too much on observable displays of power (Haugaard, 2012a). In response to this over simplistic understanding, American theorists Peter Bachrach and Morton Baratz developed the idea of 'Two Faces of Power' which widened the view of power which purely considered the power of an actor over another, now referred to as the 'first face of power to' include a second face of power (Bachrach and Baratz, 1962). This understanding of power considers a less observable aspect of power which doesn't directly involve decision making but is associated with controlling whether or not decision making can happen.

The second face of power can be considered as the power of actors, be they from within or outside of institutions, to control the agenda of what decision making is actually taking place or, to be in control of what cards are on the table, both controlling what can be discussed and also what cannot.

From their text, Bachrach & Baratz (1962) suggest that:

> '….power is also exercised when A devotes his energies to creating or reinforcing social and political values and institutional practices that limit the scope of the political process to public consideration of only those issues which are comparatively innocuous to A. To the extent that A succeeds in doing this, B is prevented, for all practical purposes, from bringing to the fore any issues that might in their resolution be seriously detrimental to A's set of preferences?' (p948). The authors go on to say that: 'All forms of political organisation have a bias in favour of the exploitation of some kinds of conflict and the suppression of others because organisation is the mobilization of bias. Some issues are organised into politics while others are organised out (p949).'

Box 2. Example – The Second Face of Power

A theoretical example of the second face of power linked to UK heat decarbonisation policy is described below:

The new energy minister in the Department for Business, Energy and Industrial Strategy has a strong personal belief that decarbonising the gas grid using biogas is the best approach to decarbonise heat in the UK. With her power over the department, she commands civil servants to set up a new heat decarbonisation forum formed of industry players focusing on biogas. This forum provides advice on policy decisions around subsidy support and innovation funding for heat decarbonisation. Because the minister has set the agenda of the heat forum to focus on biogas, its members are linked to the biogas industry. Naturally the forum's recommendations promote policies and innovation for biogas at the expense of other technologies. The agenda of the heat decarbonisation forum has been set and as a result, biogas as a

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technology option is very much on the table whereas other technologies are much less so. An element of UK heat decarbonisation policy development now has a bias in favour of a particular technology.

This is a clear example of the second face of power. However, this example highlights how the second face of power can be linked to other elements of power. As a result of her institutional position, the minister has power over departmental decisions, to set up the forum so that it contains a high number of biogas interests – and therefore has a biogas heavy agenda. The minister could be seen as having power over the department which in turn allows her to (potentially inadvertently) lean the policy agenda towards biogas.

Although many accepted Bachrach and Baratz's arguments, it was argued that analysing the second face of power was a very difficult, or even impossible task because it doesn't display itself like the much more observable first face (Hay, 2002). Bachrach and Baratz suggest investigating the so-called mobilisation of bias in the institution under scrutiny by looking at who gains from bias and who suffers and how this status quo is maintained and by whom (Haugaard, 2012a).

This new idea of a second face suggested that power was something which acted everywhere at all times, no longer just when decisions were being made. Rather than being episodic i.e. something that happened at certain points, the second face of power can be something that is institutionalised and fixed, a more structural rather than purely agent based face of power where one actor has power over another. The idea of setting the agenda or mobilising bias continues to be an important concept in both power studies and political science (e.g. Birkland, 1998 and Dür, 2008b).

4.1.4 The third face of power and structuralism

The so called second face of power is widely recognised as a real word social phenomenon and is now a key concept in power studies. However, the development of power theory did not stop at the second face, as theorists began considering other aspects of power including a so-called third face (Hay, 2002).

Steven Lukes is recognised as being a key theorist on power issues and his seminal 1974 publication 'Power: A Radical View' (Lukes, 1974) set out to develop an 'operational' (p9) approach to understanding power. Lukes suggested that the work of Bachrach and Baratz was a good move forward when considering the role of agenda setting and organised bias explaining:

> 'As Bachrach and Baratz themselves maintain, the domination of the defenders of the status quo may be so secure and pervasive that they are unaware of any potential challengers to their position and thus of any alternatives to the existing political process, whose bias they work to maintain' (Lukes, 1974, p21).

The setting of the agenda could be so powerful that actors may not even realise it had been set. However Lukes took this idea further and suggested that the approach of two faces required radical change and focusing just on behaviour, observable or not, as previous theorists had done was not comprehensive enough. Lukes proposed that there will be socially structured and culturally patterned group behaviours which are maintained by the actions of groups formed of individuals but which are not attributable to specific individuals; this change widened modernist understandings of power to include more structural aspects i.e. linked to society as a whole rather than to specific actors (Lukes, 1974). He went on to suggest that there are structural effects where the mobilisation of bias in agenda setting can come from an organisation itself as a result of its history. Box 2 provides a good example of this idea of historical events or situations, it was the minister that originally set up the forum as a result of her power but the forum is now institutionally set and could exist beyond the tenure of the minister.

Further still, and in adding in a third face of power, Lukes suggested that actors can have power by controlling the thoughts and minds of others in order to control behaviours at a more structural and societal level. Lukes explains:

> 'To put the matter sharply, A may exercise power over B by getting him to do what he does not want to do, but he also exercises power over him by influencing, shaping and determining his very wants.'…'Indeed, is it not the supreme and most insidious exercise of power to prevent people, to whatever degree, from

having grievances by shaping their perceptions, cognitions and preferences in such a way that they accept their role in the existing order of things, either because they can see it as natural and unchangeable, or because they value it as divinely ordained and beneficial?' (Lukes, 1974, p24).

Under this new understanding, power is no longer something which actors have over other actors or the ability to keep issues off or add issues to the agenda. Power is also something which exists in an even wider structural context than the second face. Actors can have power over other actors by affecting their views and preferences; these affected views and preferences result in behaviours by the dominated actors which reflects their perceived desires but actually reflects the desires of the dominating actors. Lukes suggests that the third face of power makes actors less free and unable to use reason correctly (Lukes, 2005).

Swartz (2007) and Dowding (2006) suggest that understanding how actors achieve domination over other actors is the key issue Lukes tries to address through his third face of power. Indeed, Lukes (2005) suggests that the new approach can help understand '*the various ways of supressing latent conflicts within society*' (p59) implying that those dominating can constrain actors from doing certain things. Lukes explains that his text refers to both political and sociological power issues and it's clear to see how this third face could relate to society. Examples could include the suppression of societies by the state using media control to control thoughts and preferences or the suppression of societies using religion as a tool of domination. Clearly, in this understanding, the relationship between the knowledge/information which is used to control preferences and power is very strong.

In 2005 Lukes released a second edition of his 1974 book in order to update his theory. In this work Lukes (2005) makes clear that he sees power as a capacity of actors i.e. something which can be deployed by an actor rather than it being an event or instantaneous force. Lukes also differentiates between active and passive power where passive power can be considered more structural or institutional and active more closely related to specific observable outcomes or conflict and the role of agents. The concept of active and passive power has similarities with some international relations' (IR) understandings of power

which conceive of power as 'hard' (the use of coercion and payment) and 'soft' (attraction, agenda setting and preference shaping) (Nye, 2009). As explained previously, this thesis is specifically interested in the more active elements of the power of actors although some attention will be paid to other more passive and structural elements of power which may be related.

As a concept, the third face of power in itself is not particularly complex and it is possible to consider examples where societies or social groups have their preferences shaped in order to make them accept their place '*in the existing order of things*' (Lukes, 1974, p24); e.g. state controlled media . However, the third face of power in the context of policy change implies that actors in the policy process may be dominated in a way which shapes their thoughts and preferences and results in a policy decision which reflects the desires of the actors doing the domination. Indeed, scholars interested in more discursive approaches to power (e.g. Carstensen and Schmidt, 2016), climate governance (e.g. Marquardt, 2017) and structural change (e.g. Avelino and Rotmans, 2009) refer to Lukes' approach to power as simply 'preference (-) shaping' (p321, p170 and p547 respectively) suggesting it is less about maintaining the existing order of things but is instead about shaping policy preferences to affect change.

But even taking the third face to mean preference shaping could be particularly complex from an analytical perspective. The development of policies could involve various interested actors who may be attempting to shape preferences of policy makers at the same time in different ways. Box 3 below highlights a potential example of how the third face could affect a heat policy situation.

Box 3. Example – The Third Face of Power

A theoretical example of the third face of power linked to UK heat decarbonisation policy is described below:

The UK's gas networks have been carrying out a campaign aimed at MPs using emails, letters and social media and the general media. The campaign aims to convince the MPs that gas is a sustainable fuel for the future which can help meet carbon reduction targets and reduce fuel poverty. This campaign is continued for many years and the idea of gas as a clean fuel (whether true or not) has gained traction with many politicians. Policies to

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remove gas from homes and businesses become increasingly unpopular for policy makers who perceive gas as a green fuel and as a result, the UK's heat sector does not become decarbonised in line with the Climate Change Act target.

Clegg's (1989) text on power, provides a visualisation of Lukes' three faces of power idea which is reproduced in Figure 4-1 below. The model shown in Figure 4-1 considers the various elements of the three dimensions of power considering how the different dimensions (or faces) can be observed. The diagram breaks down each face of power into its elements such as 'objects of analysis', 'indicators' and 'field of analysis' providing a potentially useful applied approach to understand power. The diagram suggests that the three faces framework is formed as a nested hierarchy, with the second face approach incorporating the first and second faces and the third face view incorporating the first, second and third faces. This implies therefore that if you are interested in the second or third face of power, you should also consider the first or first and second face respectively in order to gain a complete picture. Clegg's approach highlights the potential connections between different elements of power and the issues with looking at specific elements of power in isolation.

Key elements	First dimension	Second dimension	Third dimension
Objects of analysis	Behaviour	Interpretive understanding of intentional action	Evaluative theorization of interests in action
	Concrete decisions	Non-decisions	Political agenda
	Issues	Potential issues	Issues and potential issues
Indicators	Overt conflict	Covert conflict	Latent conflict
Field of analysis	Express policy preferences revealed in political participation	Express policy preferences embodied in sub-political grievances	Relation between express policy preferences and 'real interests'

Above the table, stacked boxes read:

- One-dimensional view incorporates only the first dimension
- Two-dimensional view incorporates the first and a second dimension
- Three-dimensional view incorporates the first, second and a third dimension

Figure 4-1. The three dimensional framework, (Clegg, 1989, p90)

4.1.5 Post-structuralism and Michel Foucault, the fourth face of power

Despite the clear increase in sophistication and scope in understandings of power with the addition of the third face, it has been argued that there are still more elements of power to consider beyond the three faces. 'Post-structuralist' approaches such as concepts of discourse, language and the de-centering of the human subject have had an ongoing effect on understandings of power (Clegg, 1989). The term 'post-structural' is seen within the power debates to generally describe the work of Michel Foucault and represents a move on from or critique of previous structuralist debates; both structuralism and post-

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structuralism are linked to French intellectual debates in the decades following the second world war (Harcourt, 2007).

Critics of Luke's three faces of power claim that the approach took a morally relative approach and that in order to understand the third face, a normative judgement would need to be made on what the interests of the subject being studied actually were. The requirement for these moral judgements, it was suggested, implied Marxian undertones of domination by an elite (which may or may not be representative of reality) (Clegg, 1989, Clegg et al., 2014). The analysis of power using the three faces approach therefore required subjective judgements by researchers which could undermine results.

While not responding directly to the three faces approach, post-structuralism removes fixed points of reference and instead focuses on texts and representations to understand the world; in post-structural understandings of power, it is then '*knowledge that is used to structure and fix representations in historical forms [that] is the accomplishment of power*' (Clegg, 1989, p152). The post-structuralist approach to power therefore requires a focus on texts and language and how they have come to be the way they are as a result of previous power struggles.

Post-structuralism is an abstract idea which has no clear methodological approach. In order to explore the idea further, the following section drills down in more detail into the approaches of Michel Foucault who is seen as being central to post-structural understandings of power.

4.1.5.1 Michel Foucault

The fourth face or post-structural approach to power is seen by some as essentially Michel Foucault's understandings of power (e.g. Haugaard and Ryan, 2012, Harcourt, 2007; van Tatenhove, Edelenbros and Klok, 2010). However, Foucauldian approaches to power, like the wider power debates, are often considered complex, undetermined and difficult to apply. This section firstly considers some of what Foucault actually said about power and then goes on to consider the view of others on Foucault's understanding of power.

In an interview on the topic of power with Foucault himself, in what appears to be an attempt to distance himself from power he explains '*I scarcely ever use the word* [power]' (Gordon, 1980, p115). Foucault goes on to describe how he

links power to the historical development of institutions and practices and explains that power can be thought of as productive (i.e. causing things to happen) rather than limiting (constraining change) and is very closely linked to ideas of truth production (Gordon, 1980). One example of Foucault's consideration of power is the novel 'Discipline and Punish'. This novel considers the move from physical forms of state punishment to incarceration in prisons; this change is seen as the power and control of the state which is acted out and reproduced through the bodies of individuals (Foucault, 1977).

In an essay, 'Subject and Power', Foucault explains that the goal of his work '*has not been to analyse the phenomenon of power*' (p326) but that his work is more interested in the importance of the subject (i.e. individuals) rather that power per se (Foucault, 1994). He goes on, '*power relations are more rooted in the whole network of the social*' p345. In 'The History of Sexuality- Volume 1' which followed 'Discipline and Punish' Foucault does take a more direct approach to power (and uses the word frequently) but suggests that that the purpose of the enquiry is not to develop a theory of power but to consider certain power relations associated with repression, in this example specifically associated with sexuality (Foucault, 1998).

While Foucault may have explained that he was more interested in the role of individuals as reproducing expectations and behaviours rather than specifically power, others see Foucault as central to understandings of power. Schirato *et al.*, (2012) suggest that Foucault is an author and philosopher whose name is widely considered synonymous with power studies in general and it is Foucault who created the greatest debate and enthusiasm around power studies. It has been suggested that Foucault's work widened the study of power to include concepts which are beyond simple understandings of power as influence and pressure to include ideas such as language, discourse and the structural elements of society (Kendall and Wickham, 1999).

Mills (2003) provides a brief summary of Foucault's work which she describes as complex, mixed, changing and difficult to apply. Mills (2003) goes on to suggest that perhaps the most influential aspect of Foucault's work was the consideration of power not as the wills and actions of individuals but as the strategy and thoughts of society displayed at every moment of interaction;

power can be considered as a chain or network of relations where people are the place where power is enacted or resisted.

Haugaard (2012) adds that much of Foucault's work focuses on the importance of the role of the individual as a conduit for power within society, including the researcher themselves, as well as the importance of knowledge and discourse. He adds that Foucault's interpretation of power sees two general levels of conflict: local struggles over specific conflicts, events or truths and deeper struggles over the regime of truth production. There could therefore be seen to be some relationship between Foucauldian understandings of power and the previously considered three faces. The first face considers the power of actor 'a' over actor 'b', which could be seen as a local struggle over a specific conflict. Struggles over truth could be seen as related to the third face and the shaping of preferences. It is not however clear how the second face of power, the setting of agendas, would fit in to Foucault's idea of power, but it seems to be more closely aligned with ideas of local and more active conflicts.

In building on Foucault's analysis of punishment systems, Garland (1990) suggests Foucault sees power as: '*a pervasive aspect of social life and is not limited to the sphere of formal politics or open conflict. It is also to be thought of as productive in its effects rather than repressive in so far as power shapes the actions of individuals and harnesses their bodily powers to its ends. In this sense power operates 'through' individuals rather than 'against' them and helps constitute the individual who is at the same time its vehicle*' (p138). This view again sees the human subject as central to Foucault's idea of power suggesting that the power operating through individuals can control what they do and don't do.

Foucault's idea of power has also been seen as being closely related to knowledge or perceived truths, diffuse and as something which can have both dominating as well as empowering aspects (Powercube, 2016), this again could be seen to link to ideas of the third face of power.

The understandings of Foucault's view of power imply that power runs deeply through individuals on a personal and cognitive level affecting all behaviours of individuals and the interactions between individuals. Individuals can be thought of as conduits of power and without the individuals, power would not exist as

power is reproduced though the thoughts and behaviours of each individual. This power itself within the individual is linked to the knowledge of individuals and how that knowledge relates to the truth and where the knowledge has come from. It can be seen as linked to ideas of normalisation and the acceptance of one's position in the existing order of things.

Kendall & Wickham (1999) suggest that Foucault's three major themes and methodologies (which are not necessarily completely focused on power) are:

- Archaeology, which is the non-anthropological and non-interpretive investigative process of describing regularities, differences and transformations in the archives of discourse.
- Genealogy, which uses archaeological approaches to examine histories but also includes the analysis of power. The focus here is the lack of judgement and the move beyond right and wrong and the move past one's own knowledge. Kendall & Wickham, (1999, p29) use the following metaphor for genealogy: '*It is, in other words a methodological device with the same effect as a precocious child at a dinner party: genealogy makes the older guests at the table of intellectual analysis feel decidedly uncomfortable by pointing out things about their origins and functions that they would rather remain hidden.*'
- Discourse, which is the investigation of historical archives in order to reconstruct the material conditions of thought or language constructions at particular times or places. Foucault argues that discourses can interact with other discourses and affect non-discursive physical practices, such as torture, through discourses around law and ethics.

Genealogy is generally recognised as the key Foucauldian approach to consider the role of power (Haugaard, 2012a). Genealogy builds on archaeology but considers power as an aspect of '*the history of the present*' looking to understand how the present came to be (Kendall & Wickham, 1999, p29). Foucault produced a number of genealogical studies including the previously mentioned 'Discipline and Punish' (Foucault, 1977) and 'The History of Sexuality (volume 1)' (Foucault, 1998).

So, while Foucault's explicit focus was not power, power is clearly implicitly important within his work and others argue that his work has been central to

how power as a subject has developed. Yet a simple or working definition of power is absent from Foucault's own work (Powercube, 2016) and therefore applying Foucauldian thinking around power is a complex task requiring a judgement on what power is and then requiring a judgement on how it should be analysed.

While Foucault's approaches have been seen as a fourth face of power, it is clear that while different to the other faces, there are also links. In particular, Foucauldian approaches are linked to the third face of power (the shaping of preferences) specifically around ideas of knowledge and truth and their resultant behaviours.

The application of Foucault's idea of power within the rest of this thesis is considered in some more detail throughout the following theoretical chapters. However, whilst Foucault's approaches may have value for some analysis, it is clear that the focus of this thesis on the active and purposive attempts by actors to affect policy may not be suitable for the more abstract and structural yet individually centred Foucauldian approaches to power. Box 4 below contains two examples of how a heat policy issue could be considered from a Foucauldian approach to power.

Box 4. Example – The Fourth Face of Power

Two theoretical examples of the fourth face of power linked to UK heat decarbonisation policy are described below:

Example 1 - Around 85% of homes in the UK are heated using gas and most citizens have grown up not knowing anything different. As a result, when replacing appliances, because of their previous knowledge and experiences, consumers do not even consider the option of moving to non-gas forms of heating. Having gas heating is normalised and consumers are not aware of the environmental impact of gas heating. As a result, the normality of gas heating is reproduced through individuals and the gas system is maintained as consumers pick gas heating over other options when they replace or upgrade heating systems.

Clearly this example is very different to the previous examples in that it focuses on individuals in society rather than those involved in the policy process. Further still, the views and behaviours of the individuals in the example are also linked to other factors rather than just power; this includes the industry and products available for them to switch to and highlights the difficulty of this approach to power and the importance of the context of that power. This example, and the issues with it, show how Foucault's approach is difficult to apply to society and that it may even be more complex to consider power and policy change from a Foucauldian perspective.

Example 2 - The majority of civil servants in the UK energy department have economics degrees and their training means that their approach to policy making has a natural preference towards market based and competitive solutions for decarbonisation. The minister heading the energy department shares this view and ensures that the department focuses on competition and markets within its policies.

The UK policies created to support low-carbon heat reflect this focus and do not successfully deliver low cost decarbonised heating. However, elsewhere around the world, particularly in Scandinavia, approaches to heat decarbonisation are more state led with less of a focus on competition and are more successful; this is because, in this example, the state is better able to deliver than a market.

In this theoretical example, knowledge within the subjects involved (policy makers) clearly affects the policy outcome. However, it's worth noting that in this example no-one actually wanted the policy approach to result in a high cost outcome, showing the fourth face as a more passive policy impact, rather than a purposive attempt to have a policy impact. This example also clearly could be seen as being linked to institutions (and ideas, considered in section 5.4 and 5.2 respectively).

Overall, these examples highlight the complexity of the fourth face as an approach, particularly around policy and show it as a more passive element of

power, something which is not the main focus of this thesis. These examples both also include elements of the shaping of preferences (albeit passively) suggesting perhaps that separating the third and fourth faces of power is not without issue.

4.2 SYNTHESIZING APPROACHES TO POWER

The ever growing literature on the concept of power has meant that the topic has become increasingly broad and complex. Few attempts have been made to create a meta-theory for considering power potentially in light of this complexity and as mentioned earlier, power has been seen as a family resemblance concept (Haugaard, 2010).

It was Digeser (1992) who first referred to Foucault's approach to power as the 'fourth face of power'. With this recognition of Focualdian/post-structural approaches as the fourth face, for the first time all four faces were considered together.

The idea of four faces of power as a tool to consider the various and consolidate various approaches to power has been used since then, most notably by Mark Haugaard (e.g. Haugaard and Ryan (2012) and Haugaard (2012)) and in these examples, the four faces idea is considered a typology rather than a grand theory of power. The four faces model therefore allows a relatively straightforward descriptive approach to the concept of power which considers the key elements of the main theory around power.

On top of the 'faces' approach, Haugaard & Ryan (2012) suggest that modern approaches to understanding power are dominated by three key considerations used by scholars interested in power:

- Conflictual power games are the approaches which see power as something actors have over other actors, these are often considered as negative aspects of power and are almost forms of coercion
- Consensual power language understands power as the capacity of actors to have power, to act and to be empowered
- Constitutive power language considers both conflictual and consensual power where the coercive and domination linked elements of conflictual

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power (over) exists alongside the capacity of actors to act and have the
power to affect change

(Haugaard and Ryan, 2012b)

Goehler (2000) identifies a similar dualism in the literature on power linked to 'power to' and 'power over', the difference between transitive power and intransitive power. While it is recognised that both of the concepts are relational i.e. to do with social relationships, there are clear differences between the two. Transitive power, can be considered as the power of actor A over actor B, it is zero sum in the sense that if A has power, B doesn't; intransitive power, considers actors acting in harmony increasing power in certain situations i.e. not zero sum but increasing power thorough joint action or behaviour: the power to (do things) (Arts and Tatenhove, 2005, Goehler, 2009).

4.3 CHAPTER SUMMARY

Although this review section has only directly considered a small area of a vast subject, I have given an overview of the key themes and ideas around power and have provided routes that allow certain concepts to be investigated in more detail. The chapter has shown that the concept of power is complex and varied, with little agreement about both what it is and how to measure it.

I have shown that there have been two main stages in the development of understandings of power; a historic phase and a modernist phase. Modernist approaches to understanding power have moved from understandings which look at the power of actors over other actors (sometimes considered as the first face) to understandings where power arranges issues off or onto the agenda (sometimes the second face). The third face of power considers more structural aspects of power such as the shaping of opinion and preferences and the fourth face considers post-structural approaches to power which are linked to wider structural issues. It is important to note that there are many other ways of considering power aside from the ideas of the four faces. Actor-network theory has been suggested to be one approach which may have value for inter-disciplinary energy research (including considerations of power) such as this study (Wong, 2009). However the focus of actor-network theory on social connections and power as '*the study of associations*' rather than power as a

discrete issue (Gaventa, 2003, p10) means that a more power centered approach would be of more value here.

The four faces do represent a useful typology foer considering the key power specific approaches. In light of this, the four faces of power typology is used as a key theoretical approach to consider power issues throughout this thesis.

In addition to the four faces approach, other theoretical elements of power will also be taken forward. One key dualism in the power literature is the difference between active (agent based) or passive structural power. In Foucault's work, this emerged as two levels of power, one at a more local level of conflict and truth struggles and a deeper level of struggles over the regime of truth production (Haugaard and Ryan, 2012b). Lukes' considered this differentiation explicitly, referring to passive and active power (Lukes, 2005). In the international relations literature, ideas of hard and soft power can also be considered to reflect elements of this dualism however in this situation, all power can be seen to be purposive (Nye, 2009). Overall, this dualism reflects the importance of arguments around structural power versus agent-based power and shows that a great level of consideration of this issue is needed when considering power. Despite the research focus on the power of agents, the role of agent based versus structural power will be considered explicitly throughout this thesis.

The other key dualism recognised in the power literature is associated with difference between 'power over' i.e. domination (sometimes referred to as transitive power) and 'power to' (do things) i.e. empowerment (sometimes referred to as intransitive power particularly when actors work together). This element of power could be of particular interest from a policy perspective as actors may work together to achieve joint outcomes or indeed, actors may have significant power as a result of their positions of authority.

Overall for the purpose of this thesis, the ongoing theoretical approach to power taken forward includes three main elements of power considered in this chapter. These are:

1. The four faces of power approach
2. The differences and relationship between agent based and more structural power

3. The role of transitive or intransitive power (power over or power to).

And, *power in this thesis is understood as the ability of actors to affect policy and governance associated with the decarbonisation of heat. Therefore an actor is considered powerful or to have had power if their behaviour has successfully affected policy change.*

5 POWER, POLITICS AND POLICY

Building on the previous chapter which considered theoretical approaches to the concept of power, this briefer chapter forms the third part of the theoretical underpinning of this thesis and explains how politics and policy can be considered from the perspective of power.

Because of the radical changes needed for the UK's heat sector and the need for policy to drive these changes, focusing on policy (which as described below is closely linked to power) associated with the transformation of the heat sector is expected to highlight an important element of power within the UK's heat socio-technical system.

There is a strong relationship between the concepts of power, politics and policy and Hay (2002) explains that power is central to politics and because of the links between politics and policy, power is also central to policy issues. Political analysis is seen as the investigation of the nature, exercise and distribution of power (as well as the consequences of such applications of power) and '*power is to political analysts what the economy is to economists*' (Hay, 2002, p168). Goverde et al., (2000) explain that in political theory and political science, '*power has constantly stood out as the single most important defining conceptual issue*' (p1).

Politics can be considered as *'…the formulation and execution of decisions that are binding upon the population of a community or society and the relationships between those who make or implement such decisions and those who are affected by them*' (Johnston, 2007, p18). Clearly, the development of policies would also fit with this definition suggesting that policy development can be seen as politics.

Despite the importance of power as a major element of policy development (Arts and Tatenhove, 2005), attempts to specifically bring the social science fields of power and policy development closely together are limited in the literature. Scholars focusing on policy development do not generally directly consider 'power', even though it is central to policy and governance change. In attempting to bridge the theoretical gap between power and policy, Goverde et

al. (2000) suggest that there are five elements to consider when investigating power, politics and policy development:

1. Power over agents;
2. Power as force, violence or coercion;
3. Power as hierarchical control of rules, knowledge and discourse;
4. Power as something consciously exercised and also as veiled and embedded in structures ;
5. The difference between power over and power to.

(Goverde et al., 2000)

These understandings of power in a policy perspective are clearly closely linked to the theoretical understandings of power considered in chapter 4. Power over agents and power as force, violence or coercion (1 and 2 above) bear clear similarities to the idea of the first face of power, which considers the power of an actor to have power over another actor and get that actor to do something they otherwise wouldn't have done. Power as hierarchical control of rules, knowledge and discourse (3 above) links to the second, third and fourth face of power around agenda setting and the construction of knowledge and its reproduction through society. The idea of power as something consciously exercised versus something more structural and the differences between power over and power to (4 and 5 above) links to the dualisms also recognised in the previous chapter around passive or more structural power and active or more agent based power; this element also links to ideas of domination and empowerment considered in the fourth face of power (poststructuralism and the work of Foucault). This is helpful in that the theoretical approaches to power taken forward for the first chapter closely link to existing understandings of how power and policy are related.

Arts and Tatenhove (2005) suggest that generally modern policy analysis no longer directly focuses on power as a key analytical tool but instead emphasises the importance of discourse, governance, interdependence and institutions. Arts and Tatenhove's (2005) view of power sees it as: '*the organisational and discursive capacity of agencies, either in competition with one another or jointly, to achieve outcomes in social practices, a capacity which is however co-determined by the structural power of those social institutions in*

which these agencies are embedded' (p347). This particular approach suggests that actors can work together or separately to affect policy change but that existing structures and institutions will shape how the power plays out. This repeats the ideas of transitive and intransitive power and structure and agency highlighted in the previous chapter again suggesting that these are important issues.

In synthesising approaches to power and policy, Arts and Tatenhove (2005) suggest a three layered approach to power analysis in policy shown in Figure 5-1. While three layers are present, this model hasn't been created with the multi-level perspective in mind and it doesn't map neatly onto the MLP framework[14].

Type of power	Focus	Policy concept
Relational (transitive & intransitive)	Achievement of policy outcomes by agents in interaction	Policy innovation
Dispositional	Positioning of agents in arrangements mediated by rules and resources	Policy arrangement
Structural	Structuring of arrangements mediated by orders of signification, domination and legitimisation	Political modernisation

Figure 5-1. Three layers of power (Arts & Tatenhove, 2005, p350)

As with the approach of Goverde *et al.*, (2000), the above 'Three Layers of Power' model has clear crossover with the power literature and can be linked to the four faces of power model but places less emphasis on post-structural approaches. The relational type of power (the top layer) is comparable to the first face of power and the active role of actors during social interaction. Dispositional power is linked to the second face of power of agenda setting and the existence and roles of institutions and associated relationships. These first two elements are more aligned with a focus on agent based elements of power. Structural power around signification, domination and legitimisation is closely linked to the third face of power and the controls of thoughts and preferences as

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[14] The three layers of the model in 5-1 do generally move from agent based activities to more structural issues from top to bottom. In the MLP model, increasing structuration of activities is suggested to exist but this goes from bottom (niche) to top (landscape). It is therefore possible that if 5-1 was inverted vertically it could show some correlation with the shape of the MLP. These issues of the relationship between power and transitions are brought together in the following chapter.

well as more structural and institutional ideas of power. Arts and Tatenhove (2005) explain that the three layers of power model does not directly include Foucauldian approaches to power and the authors suggest these post-structuralist approaches are too deterministic and deny a role for human agency, something the authors suggest is a requirement for policy analysis because of the importance of agents. This calls into question the value or applicability of Foucauldian approaches to consider the influence of actors on policy change.

While there is some agreement between the two frameworks discussed which consider power and policy change, the one key difference between the frameworks of Goverde *et al.*, (2000) and Arts and Tatenhove, (2005) is the recognition of the role of post-structural approaches to power, something not included in the latter. The use of the faces of power approach alongside ideas of 'agency and structure' and 'power over and power to' as outlined in the conclusions of the previous chapter include all of the aspects of power which have been associated with policy in this section. Therefore, while the specific approaches of considering power and policy change are of interest, they do not change the fundamental approach to power taken in this thesis outlined previously.

5.1 CONCEPTUALISING POWER AND POLICY: IDEAS, INSTITUTIONS AND INTERESTS

Arts (2000) suggests that during the 1970s and 80s there was a reduction in the use of the measurement of power as a form of analysis but that more recently (at the time of his writing) the focus on measuring or analysing power has been increasing. However, the academic analysis of UK politics and policy and its explicit association with power is very limited. This could be for a number of reasons including the fact that power is notoriously difficult to apply and is a broad topic. However, this is also likely to be because as a family resemblance concept (i.e. many related parts to it but all with differences) (Haugaard, 2010), power contains many different ideas and concepts which aren't necessarily directly considered as 'power'. Therefore, researchers may be working on power without directly referring to it.

Hay (2004) suggests that the '*conventional three-fold classification of independent variables*' associated with political institutional change is made up of ideas, interests and institutions (p204). Others have also recognised these three aspects as the key areas of analysis for the development of policy (e.g John, 2012) including that specifically associated with the governance of energy system change or stability (Kuzemko et al. (2016). In research considering sustainable change in the UK and the Netherlands, Kern (2011) also highlights the general focus in the policy studies literature on ideas, institutions and interests. These three elements are all closely linked to ideas of power.

Because of the recognition of the importance of these three elements from a policy perspective, the following sections consider each of these elements and how they relate to power in more detail. This is not to say the ideas, interests and institutions approach is the only way to understand how power can affect the policy process and policy change but reflects the previous and frequent use of this approach and terminology.

5.2 IDEAS

This sub-section considers ideas in the context of policy change and how they relate to power. Campbell (2002) defines ideas as '*theories, conceptual models, norms, world views, frames, principled beliefs, and the like*' (p21) suggesting that, '*what actors believe may be just as important as what they want*' (p21). Campbell (2002) goes on to say that the ideas can be so important that they may actually affect interests (interests are discussed in section 5.3). Ideas and power are deeply related concepts and ideas can be used to help actors legitimise the need for reform, serve as intellectual maps during times of uncertainty and also help actors reach common goals (Béland 2010).

Blyth (2014) suggests that '*the most important aspects of ideas as causal factors in explanations or political change are located in this boundary-setting function...Once the parameters of discourse are institutionally set, then an important source of power is established*' (p235). This view suggests that ideas which are associated with particular policy changes can shape the policy discourse, limiting what can be discussed. While this sounds similar in practice to the second face of power, i.e. the setting of the agenda, it is unclear whether

the role of ideas in limiting discussions in this context is seen as a purposive action or a more passive impact.

While ideas can be seen as important independent influences on politics and policy development, they are often seen as related to 'institutions' (discussed in section 5.4) or sometimes even considered as a type of institution. In fact, those interested in the role of institutions have increasingly incorporated the concepts of 'ideas' and 'discourse' within their analysis (Campbell, 1998, Schmidt, 2010, Blyth, 2014). Schmidt (2010) suggests that the focus on 'ideas' and 'discourse' could in fact be a '*fourth 'new institutionalism*'' (p1) referring to this new approach as '*discursive institutionalism*' (p1). Others, with a greater focus on ideas rather than discourse, refer to this as 'ideational institutionalism' (Kangas, Niemelä, & Varjonen, 2013, p73).

There is limited evidence of the wide application of the ideational approach (i.e. an approach focusing primarily on the role of ideas) in the area of energy policy or socio-technical transformations. As described previously, Kern (2011) investigated the role of ideas, institutions and interests in the development of the Dutch energy transition approach and the development of the Carbon Trust in the UK. This work suggested that in the UK, existing neo-classical economic ideas around competition and markets meant that the development of the Carbon Trust developed in a way which aimed to maintain support for existing energy system regime actors. The Dutch economic discourse which used ideas from the 'polder-model'[15] is based on much more consensual policy (Kern, 2011, p1123). This includes non-governmental organisations (NGOs), trade associations, industry, scientists and trade unions and therefore the Dutch approach to low-carbon transition didn't focus so strongly on existing interests.

The importance of ideas in these instances could be seen to be linked to the third face of power where the preferences of policy makers shaped the development of the Carbon Trust and the Dutch approach; it is however unclear in these examples who has had power over those policy makers in order to actively shape their preferences and cause them to choose the approach they

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[15] The consensual polder model involves: 'close cooperation between political parties, trade unions, industry, and environmental organisations to solve societal problems' (Kern, 2011, p1123)

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did. Perhaps the fourth face of power could be a better analytical tool in these examples. It may be the that the thoughts and beliefs of the subjects (the policy makers) involved made them follow an approach to shaping the Carbon Trust and the Dutch transition plan as they did and the location of power is across society rather than linked to purposive attempts by actors to steer the shape of policy makers. Box 4 in section 4.1.5 considers a potentially relevant theoretical example.

More recently, Kern *et al.*, (2014) describe how the energy policy paradigm in the UK has changed from one focused on pro-market ideas to one which is now focused on climate change and energy security ideas suggesting that over time ideas and their policy impacts can change.

Separately, Kuzemko (2013a) considered the ideas behind EU-Russia energy relations suggesting that the EU's complex energy goals included ideas of security, climate change and maintaining competitive markets whereas Russia's energy policy is based on a more statist national asset approach. Kuzemko (2013a) considers ideas as being capable of structuring the policy process as ideas become institutionalised and also as a way of conferring authority through the use of ideas which are widely seen as legitimate. Kuzemko (2013a) goes on to suggest that the complexity of the EU's mixed and competing ideas around energy policy has reduced its power over Russia.

There is a wide recognition that ideas can affect policy development and governance. One key difference between ideas and other institutional approaches (considered in section 5.3) is that whereas those institutional approaches suggest more passive approaches to power, ideas can have both passive or structural power in terms of their role in shaping governance and institutions but they can also be applied by actors as a form of agent based power by using them as frames. The use of ideas as frames is considered in the following section.

5.2.1 Framing

Campbell (2002) suggests that the impacts of ideas can potentially come from their active use by actors and communities who may use them to filter policy ideas or approaches in an attempt to affect the policy discourse. McGrath (2007) recognises the role of framing within political lobbying, comparing

framing to product positioning in the practice of marketing; frames can be used to win the minds of policy makers by associating policy changes with issues which will receive attention. For example, a business interested in selling heat pumps could frame the systems as 'good for fuel poverty' or 'good for energy security' in order to convince policy makers to support the technology. Of course, heat pumps may not be good or helpful for either of these objectives.

Kangas et al., (2013) use the concept of ideas as 'frames' suggesting that '*Ideational framing is a strategic process that aims to create the basis for political decisions and to help political actors legitimize decisions to their constituencies*'(p77). Kangas et al., (2013) specifically investigated the effect of framing questions posed to members of the public on social support policies with different ideas to see if different frames significantly altered survey results; their results suggested that 'framing matters a lot' (p84) because how questions were posed had a significant impact on responses to questions.

Béland (2009 and 2010) suggests that ideas can be used as:

- Frames to shape and legitimise the need for reform and to introduce new policy;
- Ideologies which can legitimise or challenge approaches particularly during times of uncertainty;
- Tools of domination and also as useful tools for reaching shared goals.

Framing can therefore be seen as a purposive or active use of ideas for the purpose of policy influencing. There is not a great deal of previous analysis investigating the use of framing in the UK energy policy making process however, Scrase and Ockwell (2009) discussed framing associated with UK energy policy. They considered three main frames, 'access', 'security' and 'efficiency and the environment' explaining that these frames had all had policy impacts; they did not however give a clear explanation of how these frames had been used or by who but suggested that in order to have success in promoting policy change, framing must '*speak to core government imperatives*' (p52). Kuzemko (2013c) also considered the role of framing in UK energy policy suggesting that the increased framing of energy supply around security issues often within the media has politicised energy in the UK, increasing the general policy focus on energy issues.

The analysis of framing has been used in non UK energy policy settings. Nilsson *et al.* (2009) considered the various frames which emerged during the development of EU renewable energy policy suggesting that important frames in this area were innovation, energy security and the EU internal market. However, this analysis considered the presence of frames rather than their application as lobbying tools. Further framing analysis at an EU level which focused on policy change in general rather than energy suggested that the frames employed to influence policy vary by different types of actor; cause based lobbies such as charities and NGOs are more likely to use frames around social or environmental benefit whereas industry lobby groups are more likely to use economic frames (Klüver et al. 2015).

As a tool then, the frames being used by actors should be aligned with or support other government priorities in order to be successful in causing policy change. While both ideas and the use of ideas as frames are believed to have an important impact on the development of policy, framing represents a more active element of power than the concept of ideas and represents an interesting area of focus for this thesis.

5.3 INTERESTS

Interests are often recognised as being particularly important when considering political power and the interests 'lens' represents an agent based approach to power. Interests can be considered as the things which offer benefits to a particular actor, for example things which are aligned with existing business or organisational practices or focuses. While the term is sometimes used to describe the actors who are themselves interested in a particular thing, this thesis is interested in the things which actors are interested in. Under political approaches which centre on interests, actors are seen to aim towards 'maximising personal utility' (Kern, 2011, p1120) and are therefore expected to attempt to influence policy and governance in line with their interests.

In general, the 'interests' lens on power could be considered a more agent based approach to power than that of ideas or institutions because it focuses on specific actors and their behaviours. However, whilst some (realists) suggest that ideas do not matter as interests and power drive politics (Price 2006), it is also the case that some (constructivists) believe that interests are

fundamentally social constructs based on ideas (Hay, 2004). While going into further detail on this discussion is not necessary, this argument does suggest that rather than being neatly separable, ideas and interests may be closely related concepts.

The active focus of this research is more interested in the realist approach to interests that sees interests as observable real world phenomena, such as the interests of a business to make a profit or the interests of a charity to for example, aim to protect consumers. The following sub-section considers lobbying, a general term used to describe attempts by actors with interests to purposively influence policy. Reflecting the connection between ideas and interests, framing (discussed in section 5.2.1) can be considered as an aspect of or an approach to lobbying but, for the purposes of this discussion, they are in separate sections.

5.3.1 Lobbying

This section introduces the concept of lobbying and describes some of the key lobbying literature focusing on energy and sustainability policy issues.

Lobbying has been defined as '*...interest groups' contact with, and activities directed at, decision makers in an attempt to influence public policy*' (Gullberg, 2013, p612-613). Lobbying is a key concept when considering the role of the power of interests in politics. Gullberg (2013) explains that lobbying has been successful if *'a decision making body adopts a decision it would otherwise not have adopted*' (p613). Lobbying is recognised as not just being associated with political lobbying (i.e. the lobbying of politicians), but also with administrative lobbying when actors look to influence Government departments and civil servants (Rommetvedt, 2000).

Taking this a step further, Parvin (2007) suggests that lobbying is '*increasingly about plugging into a diffuse web of organisations and institutions, rather than merely establishing contacts among particular Government departments or MPs*' (p8). Lobbying activity can involve building partnerships, media management, engaging consumers, brand management, marketing and strategic advice as well as more traditional written and oral information exchanges between government and non-government actors (Parvin, 2007).

Although a literature exists on lobbying and there have been a number of studies considering lobbying and policy development (often in the US), it is recognised as being a difficult area to research. This is because of confidentiality issues whereby lobbyists and those being lobbied wish to protect their own interests and not highlight their involvement in the lobbying process (Harris and Lock, 1996). There is therefore only a limited body of work which looks to empirically analyse lobbying and much of this is recognised as being descriptive as opposed to explanatory (John, 2012).

A major study which considers the role of lobbying is Baumgartner et al's (2009) 'Lobbying and Policy Change' which reports on a very wide scale study investigating the influence of lobbying on policy in Washington DC. The Baumgartner et al (2009) work was based on over 300 interviews and considered a wide array of different policy areas. A key finding was that US policy making favoured maintaining the status quo and the status quo is also reflected in how lobbying takes place and who is able to lobby; those who represent the status quo have greater access and power.

Focusing in on lobbying associated with environment and energy issues reduces the volume of existing work further, however there are some international examples. Arts & Mack (2003) showed that non-governmental organisations did have power over the outcome of global genetic modification regulations, 'The Biosafety Protocol', using a combination of lobbying, issue promotion and public pressure.

At an EU level, whilst there is research into lobbying in general (e.g. Greenwood, (2011) who focused on EU interest representation and policy process and Dür (2008a) who considered the power of EU interest groups) the literature specifically focusing on energy lobbying or interest representation is relatively limited.

Focusing on EU level environmental and energy policy issues, Gullberg (2008) investigated the differing styles of lobbying between business and environmental interest groups around low-carbon transition policy. Again, this article highlighted a lack of research in this area but interestingly did show that different types of organisations have different approaches. Environmental organisations lobbied actors who were likely to agree with them and also had

access to more formal institutional settings, whereas businesses lobbied both 'friends and foes', often in less formal settings, in order to affect immediate policy and to build longer term relationships.

Specifically on renewable energy, Toke (2008) investigated the role of influence in the development of the EU renewables directive, observing the pressure from existing market actors to develop a trading system for renewables certificates but showed how this policy was limited by the concerns of renewable energy pressure groups. In more recent work on EU lobbying associated with the 2020 EU renewable energy target, Gullberg (2013) investigated the role of the renewables industry. Gullberg (2013) showed that early informational lobbying (providing information) to EU civil servants was a much more effective tool compared to pressure-based lobbying (using threats or rewards) because the small scale of the renewables industry meant that they didn't have the capacity to make significant threats. Other research work focusing on EU climate policy has highlighted the reliance on trade associations by businesses for much of their policy interaction (Fagan-Watson *et al.*, 2015).

At a national level within Europe, Sühlsen & Hisschemöller (2014) focused on Germany and considered the lobbying approach of the renewable energy industry. They suggested that this approach was more informal than that of Germany's incumbent energy companies. The authors introduce the term '*deep lobbying*' which they consider as something which *'shapes the intellectual atmosphere around decision making*' and involves think tanks and the media (Sühlsen & Hisschemöller, 2014, p320). When considering the four faces of power framework, the idea of deep lobbying seems to move beyond the first face of power of having the power to get someone to do something, to more structural understandings of power such as agenda and preference shaping and the importance of knowledge. If the intellectual atmosphere is being shaped by think tanks and the media, this suggests that knowledge or information is being used to shape the preferences of policy actors or those associated with policy actors in order to get them to act in a particular way. Interestingly, the authors of the study suggest that because of the scale of the renewables industry in Germany, a policy network has now developed in this area and; the renewable energy companies are no longer niche actors but could be considered as part of

the regime effectively becoming politically empowered (Sühlsen and Hisschemöller, 2014). This example highlights how power can shift over time.

In another notable study associated with low-carbon transition policy, Gullberg (2011) considered Norwegian actors and their attempts to lobby in Norwegian energy policy and EU energy policy. Their results showed that businesses believed they had better access to both Norwegian and EU policy making than environmental organisations and in general, interest groups suggested access to EU policy making was more resource intensive than efforts at a national level. This research did not however consider the success of actors in influencing policy and the resulting policy change

Overall, lobbying is seen as a central element of how actors have power over the policy process. However there is a limited literature on energy and climate lobbying at an EU level and much of what exists is descriptive rather than explanatory. The lobbying literature identified in this section also shows many of the ideas associated with lobbying can be linked back to the underpinning ideas of power discussed in the previous chapter.

5.3.2 Lobbying in United Kingdom

In the UK there has been some academic research considering lobbying in general. For example, Harris and Lock (1996) explain that during the 1980's and 1990's, the use of political lobbying grew significantly. They mention a few examples where their research showed it had an impact. These include the regulatory changes that allowed shops to open on Sundays (something that retailers had lobbied for) and levies on audio tape which never appeared and were vociferously opposed by Japanese electrical manufacturers who employed a lobbying firm. Others agree that lobbying activity in the UK, particularly by corporate actors, has increased significantly since the 1980s and argue for much greater transparency around Government access and lobbying (Miller and Dinan, 2008).

Some UK based research has considered lobbying around financial accounting measures although this focused primarily on responses to consultations and didn't consider actual policy change (Georgiou, 2005). Other research has considered UK lobbying around food and alcohol (Miller and Harkins, 2010), has investigated alcohol industry lobbying including around minimum unit

alcohol pricing (McCambridge *et al.*, 2014) and has investigated approaches used by the alcohol industry to lobby including by using consultations, parliamentary groups and long term relationship building (Hawkins and Holden, 2014). Mirroring the research on EU energy lobbying, the UK lobbying research highlighted here is generally descriptive rather than explanatory, focusing on the approaches actors take to influence as opposed to considering specific policy changes and why they have taken place.

Despite limited research, there is a clear recognition of the significant scale of lobbying in the UK. Parvin (2007) provides an interesting snapshot of the UK lobbying system. This review was carried out by an independent education charity but was supported by Ellwood and Atfield, a public affairs consultancy. The review showed that UK public affairs activity[16] was generally more widespread than is assumed, with around 14,000 employed by the public affairs sector working for public affairs consultancies and in-house for firms; the industry was suggested to be worth £1.9 billion but the exact size is hard to determine; not all public affairs professionals self-declare and others may be working on public affairs indirectly. The research also showed that the business sector was generally considered less effective at lobbying than charities. This contrasts with EU focused research which showed that at an EU level businesses believed they had better access to policy makers than environmental organisations (Gullberg 2011).

Despite the scale of UK lobbying and the importance of energy policy, there appears to be no academic research which specifically considers UK lobbying associated with energy. Some of the limited information on energy lobbying in the UK has been reported in The Guardian newspaper and simply details the interaction between civil servants and potential lobbyists at events without showing any evidence that any particular policy change had resulted from these interactions (Guardian, 2013).

The other key non-academic organisation in the UK with an interest in researching lobbying in the UK is Spinwatch which is based online (Spinwatch,

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[16] This includes not just direct lobbying of MPs and civil servants but includes wider work associated with policy development such as building partnerships, raising issues in the media and providing political advice (Parvin, 2007)

2017) and also has associated books on the methods used to influence policy (Cave and Rowell, 2014). Spinwatch is one of the few organisations to specifically consider energy lobbying on their website although their focus is on lobbying by the shale gas and nuclear energy industry, both areas where they suggest that industry has close relations to the Government (Spinwatch, 2017).

Despite the lack of research associated with lobbying, as a result of growing concern around lobbying in the UK and an increased media interest in the role of lobbying, the UK government introduced legislation requiring lobbyists[17] to join a central register of lobbyists in 2015 (HM Government, 2015b). This register has however been criticised for not covering in-house lobbyists and even then only covering limited lobbying activities (Independent, 2016). As a result, only very limited information about lobbying can be gleaned from the register.

5.4 INSTITUTIONS

The role of institutions is another key element associated with power and policy change. The term institution can be interpreted in a number of ways with some authors using the term to describe organisations such as regulators, Government departments or firms (Bolton and Foxon, 2011) whereas some understandings of the term institution can be so wide that they consider all social structures and norms (North, 1990; Hodgson, 2006). In the context of the UK heat system, taking the widest view, would mean that an institution could be the UK legal framework while at the smallest scale an institution could be the behaviour of heating engineers. The broadness of the term means that it can be difficult to apply without significant justification and an institutional focus could be linked to structural or agent based ideas of power.

Theoretically, institutions can be considered as power which has become fixed in time (Goehler, 2000). An institution can been seen as the result of a power struggle. One good practical example of this process would be the development of a UK law which has travelled through both Houses of Parliament (with significant scrutiny and power struggles) and upon receiving royal assent has

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[17] Lobbyists can be considered as individuals who sit outside of Government and whose role includes attempting to influence Government policy or regulation.

become fixed into the UK legislative framework[18]. At the other end of the institutional spectrum, a much smaller scale example could be the emergence of a social practice such as 'good manners' which has emerged from previous power plays and now become a social norm. While there is a temporal element to institutions, it should of course be remembered that institutions may not be fixed forever.

Since the 1960's, three distinct approaches to institutionalism have emerged in the social sciences in the form of historical institutionalism, rational choice institutionalism and sociological institutionalism (Hall and Taylor, 1996 and Schmidt, 2010). In the economic literature there is also the field of institutional economics which considers the role of institutions on the economy and economic performance, a field which is fairly distinct from three previously mentioned approaches (Rutherford, 2001).

Discursive or ideational institutionalism is a new approach which is increasingly being used by researchers (briefly introduced in section 5.2). As well as considering more traditional approaches to institutions, in ideational institutionalism, the role of ideas and wider discourse and language around policy and politics is considered in order to understand how this can affect the development of policy (Schmidt, 2010).

Even as just one aspect of the applied approaches to considering power, institutional approaches entail a number of different methods all with very different characteristics. Based on the understanding of the power literature it could be argued that institutional approaches are linked to more 'passive' or 'structural' forms of power as opposed to more active or agent based power. For this thesis, institutions are understood as social structures associated with the policy process in which power has been fixed which can constrain or enable actors. In focusing on more purposive approaches to power, this research is primarily interested in the behaviour and power of actors to influence policy but attention will be paid to the institutional context of purposive displays of power.

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[18] Actual UK laws become fixed by being written on archival paper and stored in the House of Lords archive in the Victoria Tower. Up until 2017 these laws were written on 'vellum', a substance made of calf or goat skin.

5.5 CHAPTER SUMMARY

This chapter has considered the links between power, politics and policy change and has shown that the three are inextricable linked although, research crossover is actually quite limited. In focusing on power associated with the policy process, this thesis focuses on one element of power in the UK's heat system. While elements of power are expected to be present in other elements of the system such as between companies in the market or associated with consumers, the focus on power and policy change in this thesis allows for an appropriately sized research project.

Ideas, interests and institutions are seen as key elements associated with power and policy change. Ideas are seen as both passive (or structural) and active (or agent based) elements of power, with ideas both passively affecting the behaviour of actors involved in policy making (linked to norms and world-views) and also being actively used to frame attempts to cause policy change. Interests can be seen as the potential winners and losers associated with policy changes and this represents a more agent based approach. Institutions can be viewed as power which is fixed such as the policies, regulations and associated governance structures but can also be linked to specific actors (and can therefore be both agent based or structural). However, the three issues are closely linked with suggestions that institutions and ideas may be overlapping concepts, that the interests of actors can be affected by ideas and that actors can use ideas as frames to attempt to influence policies.

With a focus on active and agent based attempts to affect policy, this thesis is primarily interested in how actors have purposively affected or attempted to affect the UK heat policy process. Therefore while institutions are linked to power, they are seen to represent a more passive or structural element of power and are not a direct focus of this research. Similarly ideas, in being linked to institutions, are not a central focus however how ideas are used as frames by actors in attempts to influence policy will be a key focus. The other key focus of this thesis is linked to interests in the UK heat sector and how the interests of actors influence policy change through lobbying.

The previous two chapters explained firstly, that the multi-level perspective will be used as a descriptive model to consider the UK's heat system and secondly,

that the theoretical focus on power within this thesis will be based around the four faces of power approach alongside other elements of power. Building on the previous chapters, this chapter has considered the relationship between power and policy, highlighting the potential importance of framing and lobbying when considering the role of actors in having power in the policy process. The following chapter brings together the key theoretical elements of interest to this thesis: sustainable transformations, power and policy change.

6 BRINGING TOGETHER POWER, SUSTAINABILITY TRANSFORMATIONS AND POLICY

This chapter forms the fourth and final part of the theoretical underpinning of the thesis drawing together the three theoretical elements considered in each of the previous 3 chapters.

As described in chapter 3, the theory around sustainability transitions has been critiqued for a lack of consideration of power. While there is an increasing body of work which has recognised the importance of power associated with transitions and attempting to understand it, there is little coordination of this work and no over-arching theory of power and sustainability transitions. There have also been a number of calls to focus specifically on the power associated with the policy and politics of transitions (Hendriks, 2009; Kuzemko, 2013a; Meadowcroft, 2011, 2009; Raven et al., 2016).

In recognition of the importance of power associated with transitions and the specific calls for investigations into power and transition policy, this thesis focuses on the power associated with policy which is looking to drive a UK transformation from unsustainable heating to sustainable heating.

This focus reflects previous calls for a focus on the effect of power on policy associated with transformations and allows the original research element of this thesis to be an appropriate size and have a specific focus. This research also contributes to the UK energy policy literature as there has been only a limited focus on heat decarbonisation and lobbying.

Based on understandings of power, ideas of power and policy change and the concepts of sustainability transitions, this chapter pulls together the themes from the previous three chapters and develops a theoretical framework.

6.1 CONCEPTUALISING POWER FOR HEAT TRANSFORMATION POLICY

The following section introduces a framework for conceptualising the role of power when considering governance and policy associated with socio-technical

transformations. In the framework, the UK's heat system is the focus. This framework is not necessarily about showing change but is about visualising how power can be understood in the context of multi-level socio-technical systems.

Before introducing the framework, there are two things to bear in mind. Firstly, the power associated with policy change represents just one element of the potential power associated with the UK heat system and socio-technical systems more generally. Power is likely to exist in non-policy related elements of the heat system and could for example be associated with the power of companies to promote certain technologies to consumers or the power of social groups (or cultures) to normalise certain products or service expectations. Secondly, this framework considers power as a purely social phenomenon and does not consider ideas of technological power or technological determinism, an issue which has been considered at length elsewhere (e.g. Hess, 2015). Technology is not seen as having its own power in this thesis, instead it is actors associated with technologies (such as companies, installers, politicians) who can have power over the policy process. This does not suggest the technological lock-in is not an issue but reflects the fact that this thesis is primarily interested in purposive attempts to affect heat policy[19].

In advance of the introduction of the framework, now represents a good point to recap on the key elements from the different strands of literature that feed into it.

Firstly, with regards to sustainability transformations, the UK heat system is considered as a socio-technical regime situated in a three layered multi-level perspective. This is a framework not beyond critique but which appears to fully represent the entirety of large socio-technical systems.

The 4 faces of power approach is used as a general framework to consider different elements of power alongside a recognition of the important differences (and links) between more agent based and more structural forms of power. The

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[19] It should be noted that actor-network theory does consider 'non-human' entities such as technologies in its analysis (Wong, 2016) but as described in section 4.1, the actor-network theory is not used in this thesis due to the specific power focus. Practice theory also considers physical artefacts in its consideration of practices (Shove and Walker, 2010) however a practice based approach has not been taken in this study.

other important element of power is the difference between 'power over' and 'power to' (linked to ideas of transitive and intransitive power).

With regards to power and policy change, while recognising the importance of ideas and institutions, the key focus is on the active attempts of actors to affect UK heat policy through lobbying and the connected idea of framing.

6.2 THE TRANSFORMATION POLICY POWER FRAMEWORK

This section now introduces the visual framework which considers power, policy and a transformation of the UK heat system. The 'transformation policy power framework' is shown in Figure 6-1. This framework specifically considers the UK's heat system although it could be modified for different socio-technical systems.

The framework has two axes. The vertical axis represents the three different levels of socio-technical systems considered by the multi-level perspective, the niche level at the bottom, the regime level in the middle and the landscape level at the top. The horizontal axis contains a number of different aspects of power including how this relates to the heat system (location), the actors involved, the type of policy power (based on understandings of institutions, ideas and interests and the theoretical understanding of power which considers whether power is structural or agent based and also the four faces framework i.e. which face is most likely to be present at each level of the socio-technical system.

Overall the framework has been created for two main reasons, firstly to synthesise the key ideas from the three areas of focus (sustainability transformations, power and policy change) and secondly as a hypothetical model which can be tested and built on as the research progresses. Based on the literature previously reviewed on power, policy and transformations, the following subsections will describe each of the levels of the framework and give a description of how power associated with policy may be present in the UK's heat system.
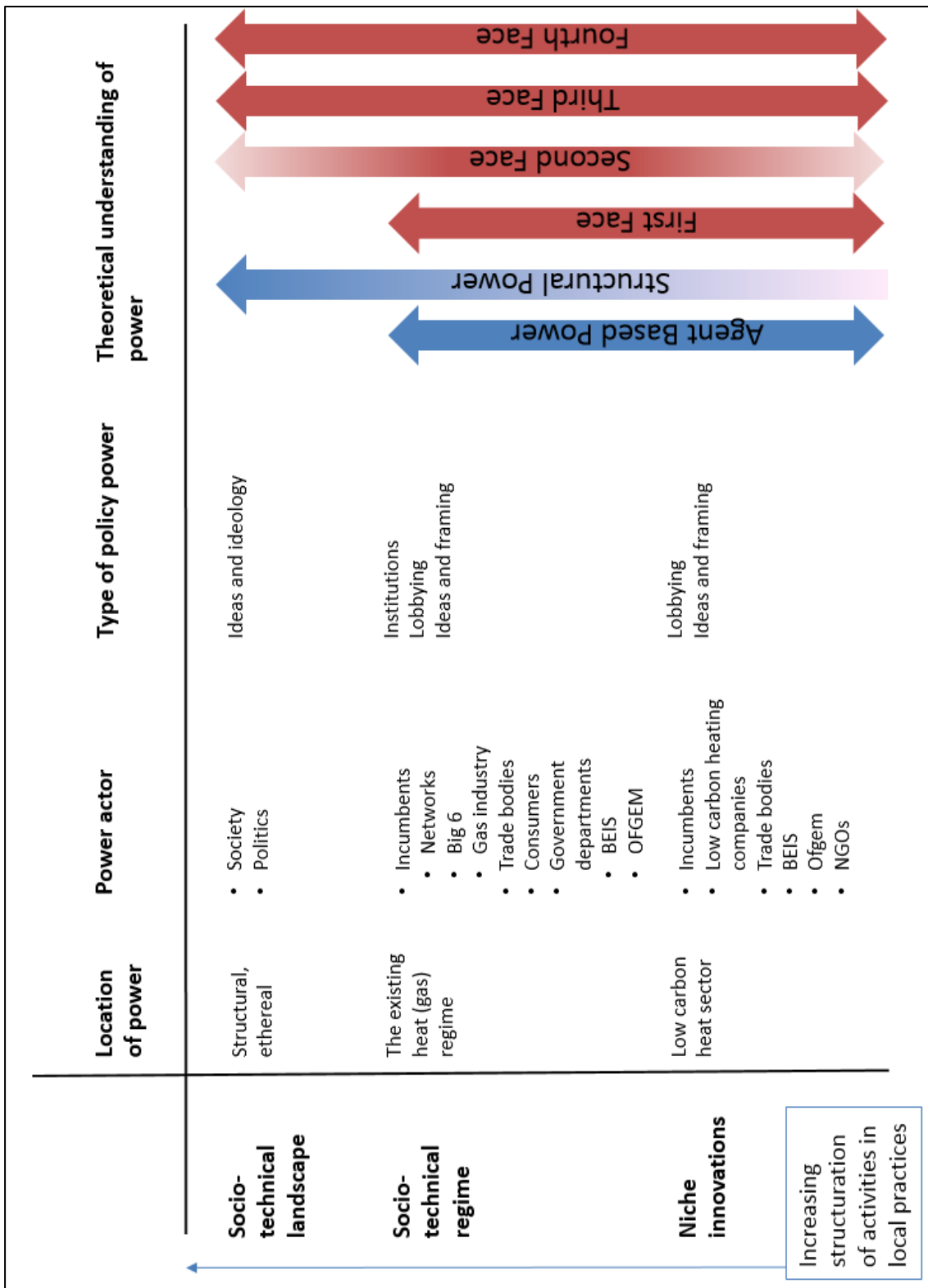
Figure 6-1. The transformation policy power framework

6.2.1 Socio-technical landscape

This top row of the framework considers the landscape level which as described in section 3.2.2.1 is not fully defined but contains contextual influences. At this level, in terms of the location of power, power is not considered to be controlled

by specific actors and so is more structural. Power at the landscape level can be considered like an atmosphere in which the power of the other levels of the socio-technical system sits and therefore, landscape level power can potentially affect power at other levels in the framework. For example, the ideological aspects of the landscape level could affect the salience of particular frames at other levels or affect consumer views.

In terms of the actors who have the power, rather than being specific actors, power is within society as a whole and within political systems. This is passive or structural power which may drive policy change in particular ways with a force or momentum of its own without being purposefully driven by specific actors.

When considering the type of policy power (whether this is ideas, institutions or interests), because of the less purposive forms of power at this level, ideas and ideology appear to be the key types of power. Therefore, understanding power as ideas using discursive institutionalist approaches and institutional understandings in general may be of most use for understanding power at this level.

With regards to a theoretical understanding of power at this level, as described previously it is clear that landscape level power is more structural and this also reflects Geels's (2011) view that as you travel from the niche to the landscape level, the structuration of activities increases in general. This is reflected in the consideration of the four faces of power model and its applicability to the MLP framework shown on the far right hand side of the framework. The more agent based faces of power, the first and second face, are not believed to be important at the landscape level because of their association with purposive or active attempts by certain actors to have power although it is possible that landscape power issues could have some effect on the setting of agendas. However, the fourth face of power is considered to be an aspect of power at all levels since post-structural understandings of power see power as reproduced through all individuals in all interactions.

Ideas are recognised as an important aspect of power at this level and it is possible to see how these are reproduced during human interactions and form part of a landscape level atmosphere, being present in for example culture and

politics. However at this level, the third face of power is also potentially important. Actors can, by using frames which support their interests (for example through marketing) potentially shape the preferences of society. While the actors promoting certain frames (considered in more detail in section 5.2.1) may be present at the lower levels of the system, their actions can potentially impact the landscape level by affecting wider societal views or beliefs.

While power at the landscape level is potentially very important, the empirical focus of this thesis on the power of actors to affect policy means the more passive or structural aspects of power associated with the landscape level are not directly considered in this research.

6.2.2 The socio-technical regime

When considering the UK heat socio-technical system, the regime level can simply be considered as the existing system for providing heat which, as described in chapter 2, is primarily based around gas for the provision of heat. Within this regime, the actors present and therefore those who could have or use power include various companies involved in heating and their associated trade associations, consumers who use heat, and also the relevant Government departments such as BEIS and the energy regulator Ofgem.

At this level, the key aspects of policy power are expected to be firstly linked to institutions which are associated with business, consumers and governance practices and act as the rules of the system. The second key element of power is expected to be lobbying, most likely by the regime industry players and also though the use of ideas and frames by industry players. At this level, policy power is a combination of both active agent-based power with actors looking to cause policy to develop in particular ways as well as more structural power associated with the role of institutions in driving policy in particular ways.

Because of the combination of various actors and both structural and agent-based power, at the regime level, it is theorised that all four faces of power may be present. The first face could be present as some actors have power over other actors through successful lobbying for example. The second face of power, the ability to set the agenda, is likely to be present at this level because of the institutional embeddedness of regime level actors. Industry actors are expected to be working closely with regulators and policy makers quite simply

because they are already present and active within the regime and have high levels of knowledge and the capacity to engage with the policy process. The third face of power could be present at the regime level as for example actors use ideas and framing to shape the preferences of other actors in order to get others (such as policy makers) to support their desired policy outcomes. As described in the previous section, the fourth face of power is believed to be present at all levels of the MLP acting through all individuals.

6.2.3 The niche level

Considering the UK's heat system in the context of a sustainable transformation, the actors at the niche level can be considered as those actors associated with the generation of low-carbon and sustainable heat; these are the actors and the technologies which may need to grow and eventually become the regime level as part of a transformation to sustainable heating. As well as small and novel companies, the niche level will also include companies and organisations not specifically focusing on low-carbon heating but which have an interest. These could include government departments and regulators looking to promote niche technologies and regime level companies who have interests in low-carbon technology. Based on previous research, it is also likely that NGOs and charities interested in environmental or consumer issues are likely to be involved in niche level developments.

At this level, it is expected that much of the power will be associated with lobbying and the use of ideas and frames as part of approaches to lobbying. Institutional aspects of power are not expected to be as important at this level as these institutions are unlikely to have developed due to the much smaller scale of the niche level and the shorter amount of time it has been operating. However, the power of institutions at the regime level could have implications for the niche level by excluding certain actors. Therefore, at this level, power is expected to be primarily agent based rather than structural.

The most important face of power at this level is expected to be the first face of power as actors look to directly have power over other actors through lobbying and the third face of power may also be important as actors use ideas and frames to promote their lobbying positions. However, because of the limited institutional involvement of the niche actors, the ability to set the agenda of

policy (the second face) is not expected to be significant but could have some impact. The fourth face, as discussed previously is expected to be present across all levels of the MLP.

6.3 CHAPTER CONCLUSIONS

This chapter has introduced a framework which pulls together the theoretical underpinnings of this thesis. The 'transition policy power framework' includes ideas from power studies, policy studies and approaches to sustainability transitions and elements of this framework will be considered in the empirical parts of this thesis.

Building on this framework, the next chapter describes the methodological approach for the empirical aspect of this thesis. The shape of this methodology is driven by the following research questions which have been developed from an understanding of the transformation needed for the UK's heat system alongside theoretical understandings of sustainability transitions, power and the policy development process. The research questions are:

1. How has UK heat generation policy been affected by the power of actors?
2. What approaches have been used by actors to attempt to affect UK heat policy?
3. Do ideas have power as frames in the heat policy process?[20]
4. How can understandings of power which emerge from this research be used to strengthen the multi-level perspective on transitions?

The research questions reflect a focus on active attempts by actors to influence UK heat policy, considering what if anything actors have changed (question 1) and what approaches actors have used (including framing) (questions 2 and 3) to attempt to influence. Question 4 is about investigating if the framework introduced in this chapter has value for approaches to sustainable transformations and how the framework may be strengthened (question 4).

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[20] This is a modified version of a proposed research question which was altered following expert engagement on the subject on focus of the thesis as described in section 7.1.1.

7 METHODS

This section describes the methodological approaches employed to answer the research questions outlined previously in section 6.3.

Briefly, the research consisted of the following elements:

1. Firstly, a small number of interviews with UK heat experts were used to assess and consider the methodological approach initially proposed.
2. At the heart of the project are two case studies. One considers UK/GB heat generation policy between 2003-2015, the second briefer case, investigates heat policy in the Netherlands and is a comparative study.
3. A number of semi-structured interviews were carried out with actors who have major interests associated with and/or knowledge of each case study area.
4. This interview data was transcribed and coded using Nvivo software and data was then analysed using a triangulation approach comparing different views alongside relevant grey literature on developing heat policies. This analysis investigated where actors had and had not been successful and also considered the approaches used by actors to attempt to affect heat policy.

A flow diagram of the overall methodological approach is shown in Figure 7-1 and each element of the approach is broken down into more detail in the following sections.
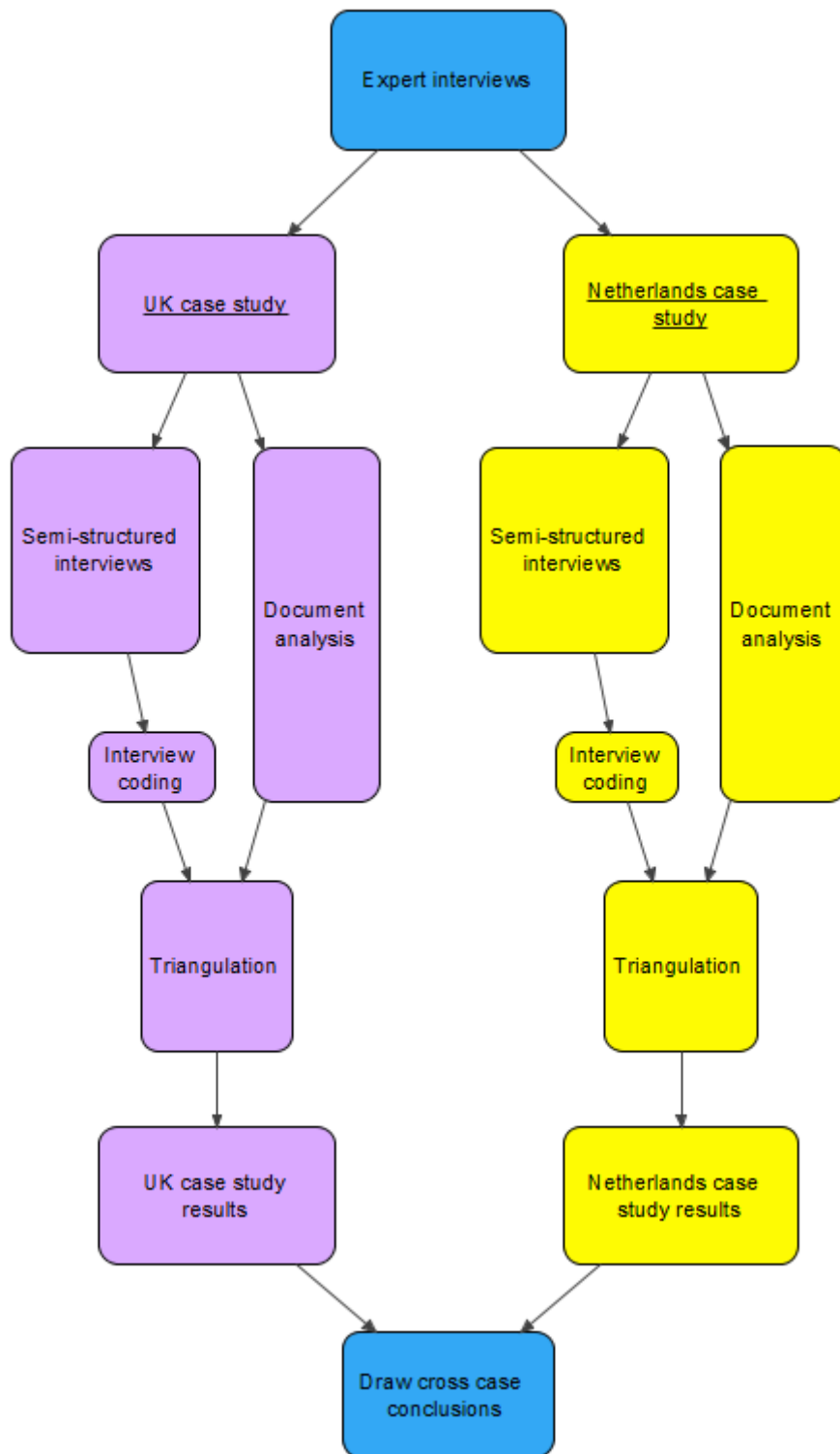
Figure 7-1. Overall methodological framework

7.1 EXPERT INTERVIEWS

Interviews have been an important source of data for the project and have been used for two phases of the research. This section focuses on expert interviews carried out at the start of the project.

Expert interviews in which the interviewer identifies subject matter experts and interviews them are recognised as an approach which can provide detailed objective data (Bogner *et al.*, 2009). Expert interviews were carried out in advance of the case study data collection in order to generate external input and allow an element of project co-design. Much like an advisory group, the experts were asked to consider the data collection techniques and project research questions, in order to hone the case study approaches and to consider the project's conceptualisation of power. These expert interviewees were also seen to be important in giving the project a greater real world grounding. In advance of the interview, the expert interviewees were issued a PowerPoint presentation which outlined the project theory and methodology alongside a list of potential interviewees for the following stages of the research. Relevant ethics procedures were also followed.

A small number of these interviews took place in March 2015 with experts on the topic of UK heat policy. Experts were identified by the author through desk based research and represented different elements of the UK heat sector. They were:

- An academic with a high level of knowledge on heat policy;
- A senior UK civil servant working on heat policy;
- An industry expert with experience of working on heat policy for one of the UK's largest energy companies;
- The chief executive of a UK trade association working in the area of heat policy.

The aim of these open interviews was to provide an applied and real life sense check to the project's theoretical framework and the general methodological approach and also to identify new contacts and actors who may be worth engaging for the further stages of the research.

7.1.1 Expert interview results[21]

The expert interviews were extremely valuable and provided useful data on proposed research ideas and methods and also contributed to discovery and selection of potential interviewees in both the UK and the Netherlands for the case studies. All expert interviewees were supportive of the study in general. However, two of the interviewees believed that there would be difficulties in measuring power and policy change (2, 4). It was suggested that there would be difficulties associated with defining power and applying it to the real world. Because of the potentially political, secretive and conflictual nature of lobbying it would be difficult to get '*honest answers from lobbyists*' (4) and attributing particular changes to particular actors may be problematic because of the many different factors and individuals at play in the policy process (2). It was also suggested that the use of the word 'power' would potentially be confusing to readers for whom it may mean electricity (2).

There was general agreement from the expert interviewees that consumers were extremely important for a sustainable heat transformation in general, in terms of uptake of technologies, culture and behaviours and that excluding consumers could limit the value of the study because consumers can have power. However, one interviewee suggested that because of the focus on power in the policy process rather than power more generally: '*I can see why you're excluding consumers within the policy debate*' (4).

The expert interviews were valuable for developing the project's methodological approach and expert interviewee concerns around getting 'honest answers' confirmed the importance of a rigorous approach to investigating power. As a result of the interviews, several changes to the project methodology were made:

1. While the word 'power' is central to the project, because of the confusion between 'power' and 'electricity', the meaning of the word power in the context of this thesis has been made explicitly clear from the beginning.
2. As a result of the complexity of applying the concept of power to real-world policy change, the use of power in terms of the policy process is described

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[21] The numbers in brackets which are present throughout the thesis from this point forward refer to interviewees. Expert interviewees are included in the overall list of interviewees included in annex 2.

using accessible language and terms such as 'lobbying' and 'influence'. The methodology has also been designed to focus on more active understandings of power such as the role of lobbying in directly causing policy changes rather than more passive understandings such as institutional or structural power. Whilst the more passive elements of power may be important and are considered throughout, the focus is on how actors can attempt to affect and have affected UK heat policy. Building on the ways in which power has been recognised as affecting policy from the literature review in the previous chapters, the focuses of this empirical research are therefore specifically around **lobbying** and **framing**.

3. While the project doesn't focus specifically on the power of consumers in the potential heat transformation, the impact of consumers on the development of heating policy is considered as part of the interview design and consumer organisations were approached for interviews.

4. The third research question was modified to reflect the focus on the use of framing approaches by actors rather than a general focus on ideas.

7.2 CASE STUDIES

This research focuses on two key heat policy case studies, covering the development of UK/GB heat generation policy alongside another national example, the Netherlands.

In order to delineate the research, the project focused only on policies associated with heat supply or generation, in the UK case study, primarily the development of the Renewable Heat Incentive (RHI) (which is active at a GB level although a similar but separate scheme has operated in Northern Ireland) and the Government's 2012 and 2013 'strategy' work on the future of heating which considers the UK as a whole. Considering heat demand policy (i.e. buildings energy efficiency policy) as well as supply would have significantly increased the scale of what is already a broad project and these issues have already received a significant level of scholarly focus (e.g. McLeod et al., 2012; Rosenow and Eyre, 2016).

The use of case studies in social research has been growing over the past three decades reflecting the recognition that the case study approach can explain in detail 'how' social science phenomenon work in practice as well as being useful

for in-depth descriptions of social phenomenon (Yin, 2014, Flyvbjerg, 2006). Case study approaches take an in-depth look at a particular aspect of a wider issue or subject (Flyvbjerg, 2006) but are recognised as having various potential formats or methods of production (Hamel *et al.*, 1993).

Flyvbjerg (2006) suggests that one issue for the writing up of case studies is the potential depth and thick description; a lack of breadth can be an issue for the use of single case studies.

My approach uses Yin's (2014) multiple case study approach and attempts to overcome the recognised (lack of) breadth issue of using a single case study by placing a number of case studies (in this case two) in a wider context. It has been suggested that the use of multiple-case designs can produce more robust evidence as the use of evidence from more than one case study may be more compelling and synthesising data across multiple cases can yield good results (Yin, 2014). The multiple case study approach proposed by Yin (2014) is shown in Figure 7-2 and bears similarities to the shape of this thesis in that there has been a theory phase, followed by case selection and methods development, parallel case studies and then the development of cross case conclusions to inform theory.
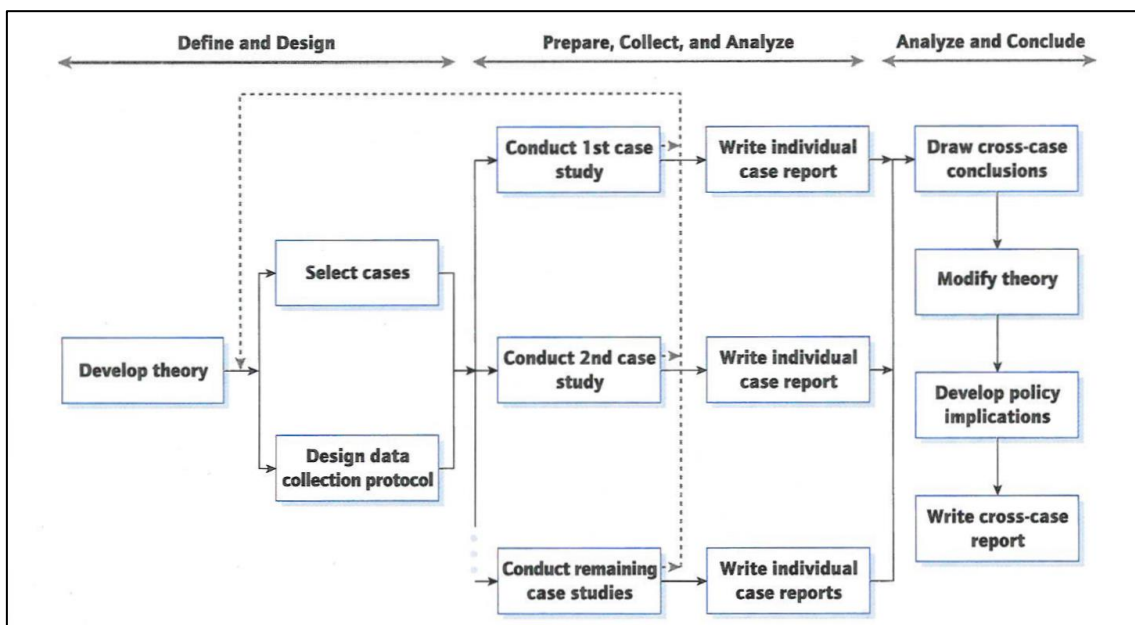
Figure 7-2. Multiple case study procedure (Yin, 2014)

7.2.1 Selected cases

7.2.1.1 UK/GB Heat Generation Policy

Initially, UK/GB heat policy was expected to be split into two separate cases, the GB Renewable Heat Incentive and the UK heat strategy. However, because of the synergies and links between the two in terms of actors, it transpired that there was one network of actors with interests spanning both aspects of heat generation policy. As such, both aspects of UK heat generation policy are considered in one case although this case study is split into chapters. This case also considers the politics surrounding the introduction of regulations which mandated condensing (rather than non-condensing) boilers. This policy change was highlighted by a number of interviewees as important and is clearly relevant when considering policy associated with heat generation.

The RHI is the Government's key policy instrument designed to support low-carbon heat generating technologies and this is a quickly developing and rapidly growing new policy. As such it is a key policy but has yet been the subject of little analysis. The RHI is central to the niche level of my conceptual framework as it is a policy designed to protect and promote new niches for sustainable heat technologies and practices.

The second aspect of the UK case study considers the UK's long-term strategy for heating. The 'heat strategy' is linked to the RHI but has separate aims and is a very different policy approach. The Government's heat strategy represents a long term vision up to 2050 which suggests how the UK will be generating and using heat in a decarbonised energy system (DECC, 2013k). Unlike the RHI, the heat strategy is not a specific policy instrument and it is not directly written into or required by legislation. However, the 'heat strategy' represents an extremely important element of UK heat policy, and provided for the first time the UK Government's view on what specific technologies and technology mixes could be used to decarbonise heat and the scale of the challenge. The UK heat strategy has been considered in previous sections and whilst various technical scenarios have been developed which question the Government's approach, the actual development of the UK heat strategy and potential politics has not been the subject of any academic research. While there have more recently been debates around the conversion of the gas grid to gases such as hydrogen

and biogas, these discussions have been taking place mostly since the research interviews for this work were conducted and this more recent time period has been the subject of other work considering incumbency in the UK heat sector (Lowes *et al.*, 2018b).

The heat strategy proposed radical changes to the existing heat regime representing a potential existential threat to some of the regime actors including gas networks and gas suppliers. However, it also represented the development of a new low carbon heating market offering significant potential opportunities as well as threats. The significant level of risk and opportunity introduced by the UK's heat strategy therefore means that the issue is expected to have been associated with power struggles.

7.2.1.2 Heat Policy in the Netherlands

The Netherlands is an interesting case because, like the UK, it has a high (in fact, higher) penetration of gas for heating and the Dutch have adopted policy goals and have practical experience of projects and policy to try and change this. The Netherlands also has a similar energy background to the UK with large historic supplies of fossil fuels. The Netherlands is therefore likely to face similar issues to the UK in moving to more sustainable heating practices, although there are of course likely to be differences between the countries. Actors involved in attempting to shape and influence policy may also have similar interests to those in the UK and so the Netherlands may represent a good international comparator to the UK.

The second case study therefore considers the role of power in the development of Dutch heat generation policy. This study is less in depth than the UK study in light of limited time in the Netherlands and the difficulties of accessing foreign policy materials. However, the case study still offers valuable comparisons to the UK as described in the results sections.

7.3 DATA COLLATION

Case studies can use a wide range of data sources including documents, archives, participant observation and physical artefacts, however, interview data is recognised as being particularly important (Yin, 2014, Stake, 1995). Because of the public policy nature of this research, the main data sources have been

interviews and grey literature rather than other approaches such as ethnography and observation.

Stake (1995) suggests a more qualitative and self-reflective approach (i.e. greater consideration of the role and views of the researcher) than others such as Yin for case studies (2014). While an ethnographic study in this area, if successful, could be extremely interesting and useful, getting close (or even internal) access to the policy making process inside Government or the influencing approaches inside a company would have been practically impossible because of issues of confidentiality. Therefore, a non-ethnographic approach based on interviews and document analysis was chosen. However, while the methodology didn't use an ethnographic approach, the role of the researcher in this research is central in relation to the lobbying analysis tool (EAR) described in more detail in section 7.4.2.

7.3.1 Interviews

Interviews are central to this project as they are a key research method for case studies (Yin, 2014, Stake, 1995). Much of the literature discussed in previous chapters which has considered power and influence over policy has also used methodological approaches which include interviews (e.g Gaede and Meadowcroft, 2016; Gullberg, 2013, 2011; Hawkins and Holden, 2014; Lockwood, 2017; Sühlsen and Hisschemöller, 2014). For the case studies here, semi-structured interviews are used. These are less rigid than structured interviews, having themes to be covered and suggested questions but with an openness which allows the interviewer to follow up on previous answers or change the interview sequence (Kvale, 1996).

This semi-structured interview approach is better suited to the exploratory nature of this research as it is felt that structured interviews would have the potential to miss aspects of power which I have not considered during the development of my theoretical framework. Unstructured interviews would be unsuitable because the breadth of the topic means that some control over the interviews will be required.

Participants for interviews were selected through the early expert interviews, my own knowledge of the heat policy network and also through document analysis, such as DECC's 2012 heat strategy consultation (DECC, 2012e) which includes

a list of respondents, all of whom clearly believe they have an interest in UK heat policy. The interviewees included those with commercial interests in the development of heat policy, civil servants and experts without specific business interests but with expertise in heating and heat policy. The balance of the type of interviewee was important for the analytical framework for lobbying, the 'EAR' instrument which is described in detail in section 7.4.2. Therefore, interviewee selection ensured that enough interviewees who could represent both policy makers and policy influencers were interviewed. A snowballing approach was also used, whereby if interviewees identified other actors who they believed may be particularly useful for the research, these would be followed up if they were expected to add value to the research.

A total of 52 interviews were carried out throughout 2015, reflecting events to that point. Most of the interviews took place in London, although there were also interviews across wider England, in Rotterdam and in The Hague. Some interviews were carried out by phone if it was not possible to carry out in person.

A list of interviewees along with their place of work is included in annex 2. These interviews are numbered and are referenced accordingly in the text of the results sections using the format: (interview number) e.g. (1).

Before interviews, interviewees filled in and signed a consent form in line with University of Exeter policy. On this form, interviewees were given the option of full attribution of comments, full anonymity or attribution but with certain comments unattributed. Ideas and quotes from anonymous interviews and unattributed quotes are labelled (anonymous) in the text. Most interviews were recorded and transcribed verbatim by the researcher however a small number were either conducted by email or were not recorded at the request of the interviewee.

The questions used to shape the semi-structured interviews are included in annex 3. The interview questions were tested prior to research interviews with colleagues working on energy policy research and were refined primarily for reasons of clarity. The 'ego' questions were the questions posed to those looking to influence policy and the 'alter' questions were those posed to those on the receiving side of lobbying and influencing. Section 7.4.2 explains more

about the use of these terms which are related to the analysis of lobbying. The first question was designed to give details of the interviewee's position and interest in the UK heat policy network. Within the 'ego' questions, questions 2-4 ask about the interviewee's own work or experience of looking to influence heat policy. Questions 5 and 6 ask about their view on the ability and approaches of others to influence policy. Questions 7 and 8 ask about the interviewee's use and experience of framing.

Question 9 asks about the 'objectivity' of policy making and the use of evidence by civil servants. This question is included because according to UK civil service guidance, civil servants are required to act objectively in their role where: "*objectivity' is basing your advice and decisions on rigorous analysis of the evidence*' (HM Government, 2017a). It is possible that those attempting to have power over policy change could try and affect or use this need for objectivity by for example providing evidence which supports their policy goals. It is also possible that policy making takes place which is not objective and is affected by power in other ways and this question also aims to explore this issue. It should be noted that while the use of 'evidence' is a requirement for objectivity under the Civil Service Code, 'evidence' cannot be assumed to be reliable or true. If 'evidence' is simply taken to mean written or recorded knowledge and knowledge is power (as some suggest, see chapter 4), then clearly the evidence on which 'objective' policy may be based could have been affected by power and this power within the evidence could affect policy making.

Finally, question 10 asks about preference shaping, in an attempt to gain evidence around the third face of power.

The 'alter' questions, delivered to interviewees who were policymakers or not associated with heat companies, were similar questions but the questions reflected the position of 'alters' as individuals who may be or have been lobbied.

While the interview questions were shaped around the overall project research questions, the questions and semi-structured nature of interviews in general allowed for a wider consideration of ideas of power within the development of heat policy rather than purely considering lobbying and framing.

7.3.2 Grey literature

Alongside the interviews, grey literature was another vital source of data in examining both actual legislative and regulatory changes and various approaches to influence heat policy. Grey literature included Government documents such as legislation, strategy papers, consultations and responses and committee reports. This grey literature also included data from wider industry relevant to the specific case studies including consultation responses, company reports and web pages. The use of grey literature is fully referenced throughout the text.

7.3.3 Data organisation

Following the interviews, interview data was transcribed directly into NVivo software, a widely used tool for qualitative data analysis. NVivo was then used to organise (code) the many different types of data into related topics or themes for analysis. This capability makes NVivo particularly useful for data triangulation techniques and the generation of case study reports (both described in more detail in the following sections).

7.4 DATA ANALYSIS

Yin (2014) suggests that high quality case study analysis is underlined by four key principles:

1. Analysing all available data;
2. Assessing all plausible rival outcomes for your conclusions;
3. Addressing the most significant aspects of your case studies;
4. Maximising the value of your own a priori knowledge.

Stake's (1995) focus on personal descriptions echoes this idea of making the most of your own knowledge, however the risk with this approach is that prior knowledge and the subjectivity of the researcher can cloud objective judgements. Therefore, whilst I made the most of my own knowledge in terms of the design of the project, I attempted to separate my own knowledge and preconceived ideas and experiences from the results; case study reports were purely based on the data collected and analysed as part of each case.

The use of triangulation, whereby data from different sources is compared and contrasted is recognised as a very useful approach for analysing case study

data (Yin, 2014, Stake, 1995). Its name comes from its use in navigation where the location of a point is determined by measuring angles to that point from other known points. Stake (1995) suggests that despite its importance within case study approaches, triangulation is only necessary when data is contestable. However, for this research, because of its focus on power and politics which is likely to be contestable and conflictual, the use of triangulation will be used as standard where possible. Triangulation is also central to the chosen approach to analyse lobbying (The EAR instrument) described in section 7.4.2.

7.4.1 Coding

The key interpretive stage of analysis was the coding of the interview data in NVivo. Codes (described as 'nodes' in NVivo) can be considered as categorising devices for qualitative data (Basit, 2003). Coding is quite simply the organising of data into themes or categories to allow for ease of analysis.

The coding process coded the interview data by emerging theme or issue and to a specific actor or group of actors. In practice, this meant that if a quote within an interview was linked to the project research questions, or power and influence in general, it would be coded to the specific relevant theme. Therefore, some codes emerged naturally from the data and some codes were also based on research questions. However, the actual results emerged fully from the data and no presuppositions about power were made in the coding structure or process.

In general, the codes fitted into three main themes of 'What', which included successes and failures of attempts to influence policy; 'Who', which considered the actors involved; and 'How'' which included the various methods used to attempt to influence policy. The 'How' element of the coding also specifically coded issues of framing and the frames used by actors as these emerged from the interview data.

While coding also attempted to organise power issues into the relevant face of power, the faces of power didn't actually appear particularly clearly through the coding. Instead, faces of power were primarily considered and emerged during the synthesis and write up of the results sections.

The results chapters are based around the three over-arching codes and the coding process has provided not just a useful way of organising data but has been valuable for the overall shape of the results.

Within some of the codes, there were also sub-codes (daughter codes) and sub-codes within these sub-codes which represented sub-themes or sub-issues. There were also some codes outside the three main themes, for example some quotes highlighted methodological issues with the research and these were collated. An extract from NVivo is show below in Figure 7-3 which shows some codes expanded into sub-codes and sub-sub-codes.

Nodes				
Name	/	Sources	References	Created On
condensing boilers		1	2	02/03/2016 13:01
creation of rhi		2	17	07/03/2016 11:53
Face of Power		0	0	01/12/2015 12:23
How		0	0	01/02/2016 17:38
Evidence-Information-Knowledge		0	0	01/12/2015 11:51
Ideas, Myths and Frames		1	1	01/12/2015 12:17
Scale		1	1	01/12/2015 12:21
Style		1	2	18/01/2016 11:40
Aggressive and negative Approaches		13	24	01/12/2015 13:49
Exaggeration		1	2	26/01/2016 17:46
Image		11	13	01/12/2015 12:22
Legitimacy		10	12	01/12/2015 12:02
Positive messaging		7	8	07/01/2016 10:09
Use of balanced and mirroring approaches		17	40	01/12/2015 12:01
Inertia-Institutions-Lock-in		0	0	01/12/2015 12:05
LPG		1	3	17/03/2016 10:14
Methodological Issues		11	16	01/12/2015 17:34
Other considerations		0	0	01/12/2015 12:24
What		0	0	01/02/2016 17:37
Who		3	4	01/12/2015 12:22

Figure 7-3. An extract from NVivo showing all parent codes with some sub-codes expanded.

7.4.2 Lobbying analysis

There are a number of different approaches to analyse lobbying. Arts & Mack (2003) consider political influence on the United Nations Biosafety Protocol using a reputation method which uses in depth interviews to understand the reputation of particular actors from the perspective of other actors. The theory is that in the context of social relations, reputation is very important and can be a

proxy for influence. However, this approach doesn't necessarily show that there have been actual policy changes which are attributable to certain actors.

Dür (2008) suggests that as well as the previously mentioned approach of looking at reputation, another approach is to consider the distance between the preference of actors and the actual policy outcomes (referred to as 'preference attainment'). The clear risk however with this approach is that correlation doesn't signal cause and there are many reasons why a policy may or may not be changed. It may simply be a coincidence that a policy outcome matches an actor's preferences and there are clearly many more ways policy can be changed than because of role of one particular actor.

Dür (2008b) expands on methodological approaches within his previous work and suggests that methodological triangulation can meet many of the shortcomings of methods described previously by combining a number of approaches. Dür (2008b) cites the 'EAR instrument' (p570) as one particularly systematic approach to triangulation.

In 1999, Arts & Verschuren (1999) introduced the 'EAR' (p411) instrument (also see (Arts, (2000)) as a triangulation tool which takes into account firstly the political player's own perception of their influence ('E' for Ego perception), secondly, the other players' perception of influence over them (the person being lobbied, 'A' for alter perception) and thirdly analysis of the development of policy and regulations by the researcher ('R').

In this approach, understanding the 'ego' perspective can give the researcher insight into what the preferences of the actor trying to change policy are and where that actor believes it has been successful; speaking to 'egos' can also provide data on the reputation of other actors, as 'egos' may explain who else has been active and successful at policy making. Understanding the 'alter' or policy maker's perspective can provide data on where and how policy has been successfully influenced by lobbyists and can also provide information on the reputation of actors involved in lobbying activities.

The data from the 'egos' and the 'alters' can then be triangulated with analysis by the researcher. The researcher uses archive and document data to understand how the policy has actually changed and can also investigate whether there is any further evidence that the policy changes can be attributed

to that particular actor. In a detailed description of the 'EAR' instrument, Arts and Verschuren (1999) (and also in a separate publications Arts, (2000)) explain that in order to fully consider the various factors at play during policy development influencing activities, attention must be paid to:

- Whether or not the 'ego' met their goal for influencing;
- Whether the 'ego' had access to the policy process;
- Actual interventions in the policy process as well as the number and frequency of these;
- Whether their views are adopted by policy makers;
- External or autonomous developments which could have affected policy changes.

Figure 7-4 shows how this approach would work in practice. The 'EAR' approach has clear elements of 'process tracing', an approach whereby case studies are considered according to the preferences and activities of actors and the extent to which polices are changed in line with these preferences and actions (Dür, 2008a). However, process tracing of the policy process has been described as a method which: '*through detailed case studies, can take interacting causal variables into account'* but which does not purely focus on power or lobbying (Kern, 2011, p1121).
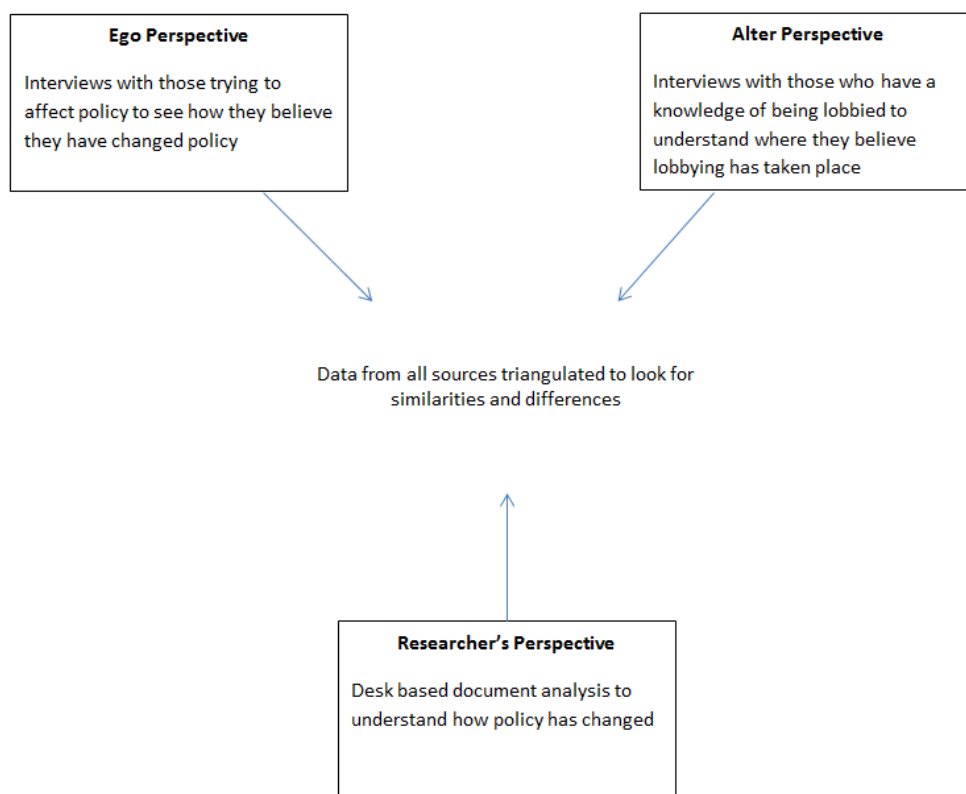
Figure 7-4. My approach to the triangulation process for the analysis of lobbying based on the EAR instrument (Arts and Verschuren, 1999)

The strength of the EAR approach is that it combines elements of the previously described reputation methods and policy attainment methods. It also builds on these approaches taking much greater account of grey literature and the view of the actor being lobbied. While combining methods and approaches in triangulation has clear benefits, it is not without its risks as it can increase the time and complexity of data collection and possibly show competing results (Dür, 2008b).

Direct examples of the application of the EAR instrument are limited. One notable example is its use to consider EU foreign policy, however even in this study the instrument was used differently as process tracing was central and the perceptions of actors were used as a secondary element to validate the process tracing (Schunz, 2010). Without mentioning the EAR instrument, Gullberg (2013) used a similar triangulation approach which analysed written sources of data and also used semi-structured interviews with interest groups and decision makers to consider whether there had been successful lobbying associated with binding EU renewable energy targets.

Despite the limited application of the EAR triangulation approach, the EAR instrument represents an applied and possibly more verifiable approach than other methods which investigate the role of influence and lobbying on policy development. By combining methods, it overcomes some of the shortcomings of attributed influence and preference attainment methods which may produce false positive results as a result of coincidental or chance factors. However, even the creators of the 'EAR' instrument recognise it may not be flawless. Arts and Verschuren (1999) explain that '*in the case of complex decision-making, it is unthinkable that all relevant documents should be available to the researcher*' (p418) and this could limit the potential for researcher analysis and increase reliance on interview data. Dür (2008b) also suggests that the complexity of combining methods may increase the time required for analysis and reduce the potential for the number of case studies and therefore the potential for generalisations.

Nonetheless, because the approach of triangulation and the use of semi-structured interviews are recognised as being important approaches for case studies and these methodologies are also central to the EAR approach to analysing influence on policy, I use the EAR approach as visualised in Figure 7-4 in my approach to analysing lobbying. I also consider wider contextual factors highlighted by Arts and Verschuren (1999) around whether lobbying goals were met, whether lobbyists had access to policy makers, types and frequency of influencing interventions and wider developments. Furthermore, Yin's (2014) approach to case studies which suggests maximising the use of the researchers a priori knowledge matches neatly with the part of EAR approach which relies on policy analysis by the researcher. I already had a good understanding of the UK heat policy network. The use of the EAR approach also represents an original application of this technique to UK energy policy.

7.4.3 The analysis of ideas and framing

Ideas represent a more abstract research area than lobbying and unlike lobbying, there are only currently loose approaches for how researchers can understand ideas and the impact that they have on politics and policy. As described in section 5.3, there are numerous approaches to investigate institutions with so called 'discursive institutionalism' focusing on ideas as institutions.

The approach of considering ideas as frames (considered in section 5.2.1) provides an approach to ideas which focuses on how ideas are purposively used by actors in the development of policy. There are no clear methods for considering framing and so my analysis of frames and their role within the development of UK heat policy will use the triangulation approach described earlier in relation to lobbying. So, in addition to considering how policy has been affected by lobbying, I will also be investigating how ideas have been used as frames by actors in order to attempt to cause policy change.

This approach to consider framing is very similar to the approach to analyse lobbying, based on the EAR instrument described previously. It relies on interviews with those trying to change policy 'ego', interviews with those who are the target of the influence 'alter' as well as desk based analysis by the researcher to see if the frames observed in the interviews are reflected in policy developments.

The analysis of ideas as frames is a relatively new approach to understanding political change and there have only been limited attempts to put this into practice. Based on a wide analysis of literature around ideas and influence, Shorten (2013) proposed a 'typology' suggesting how ideas and influence can be studied in politics which contains five potential types of influence using ideas. While this typology doesn't specifically refer to framing but to ideas in general, the author suggests ideas can be employed as:

- Mediated influence is where original ideas have subsequently been re-used by different actors and have an impact on policy;
- Unconscious influence is where ideas affected political outcomes but the source of how they have arrived with particular actors is not clear;
- Adoptive influence is where ideas are actively adopted by actors;
- Distorted influence is where ideas are deliberately misrepresented or distorted;
- Cumulative influence is where ideas have grown, merged and developed over time to have an influence.

The typology provides an interesting set of potential concepts of how frames could be employed by those looking to influence including by repeating the framing of others or by misrepresenting the frames of others. In order to

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maintain the focus on active or purposive use of framing in UK heat policy, the analysis of framing in this thesis considers primarily what frames (if any) are being used and who is using them rather than how frames have emerged. However in light of what appears limited methodologies to consider framing, Shorten's (2013) typology is considered during the analysis of framing.

7.4.4 Case study reports

Following the analysis of lobbying and ideas within each case study, a report has been produced detailing the results and conclusions of each case. The UK case study is broken down into three chapters which consider firstly the key policy changes, secondly the key actors involved and finally the approaches used to influence. Stake (1995) explains the importance of the case study report itself as the key way of communicating the findings of the study and includes a checklist to consider when writing up the report in order to make the report clear, readable and valuable. The checklist is shown in Figure 7-5 and includes practical aspects to check when producing the final reports.

Critique Checklist for a Case Study Report

1. Is this report easy to read?	Very ☐	So-so ☐	Hard ☐
2. Does it fit together, each sentence contributing to the whole?	Very ☐	So-so ☐	Misfit ☐
3. Does this report have a conceptual structure (i.e., themes or issues)?	Yes ☐	A little ☐	None ☐
4. Are its issues developed in a serious and scholarly way?	Yes ☐	A bit ☐	None ☐
5. Is the case adequately defined?	Yes ☐	So-so ☐	Poorly ☐
6. Is there a sense of story to the presentation?	Strong ☐	Some ☐	None ☐
7. Is the reader provided some vicarious experience?	Yes ☐	A bit ☐	None ☐
8. Have quotations been used effectively?	Yes ☐	A bit ☐	No ☐
9. Are headings, figures, artifacts, appendixes, indexes effectively used?	Very ☐	So-so ☐	No ☐
10. Was it edited well, then again with a last minute polish?	Shiny ☐	Nicks ☐	Rough ☐
11. Has the writer made sound assertions, neither over- or underinterpreting?	Yes ☐	So-so ☐	No ☐
12. Has adequate attention been paid to various contexts?	Yes ☐	A little ☐	None ☐
13. Were sufficient raw data presented?	Loads ☐	So-so ☐	Weak ☐
14. Were data sources well chosen and in sufficient number?	Strong ☐	Some ☐	Weak ☐
15. Do observations and interpretations appear to have been triangulated?	Yes ☐	A bit ☐	No ☐
16. Is the role and point of view of the researcher nicely apparent?	Nicely ☐	A bit ☐	None ☐
17. Is the nature of the intended audience apparent?	Yes ☐	Some ☐	No ☐
18. Is empathy shown for all sides?	Yes ☐	A bit ☐	No ☐
19. Are personal intentions examined?	Yes ☐	A bit ☐	No ☐
20. Does it appear individuals were put at risk?	Yes ☐	A bit ☐	No ☐

Figure 7-5. Critique checklist for a case study report (Stake, 1995, p131)

The checklist was used as a guide when completing the case studies. The Dutch case study also considered similarities between the GB and Dutch case studies. Cross-case conclusions were drawn in order to combine and synthesise the outputs of the project into overall project conclusions and in order to answer the research questions.

7.5 RESEARCH LIMITS

The concept of power is a large and complex topic and the research questions have been designed to take this into account and shape the research into a manageable size. Research questions (shown on p134) one, two and three focus on two major issues, the direct role of actors in the policy process (1 and 2) and the role of ideas used as frames by actors in the development of heat policy (3). Question 4 is designed to situate the overall project theme of power and policy within the wider debate around sustainability transitions.

Based on the previous literature review, the aspects of power considered by the research questions are clearly important elements of the power that actors can have on the policy process and an important element of power in general. It is however important to note that there may be other aspects of power which may have an impact on policy development which are not the primary focus of this thesis; these features are primarily associated with more institutional, structural or passive elements of power which are not associated with purposive attempts by actors to attempt to cause policy change. It has been necessary to focus on the more active or purposive approaches to power in order to ensure the thesis is an appropriate size. While I accept that this thesis does not cover all elements of power within heat policy and transitions/transformations, the exploratory nature of my research sheds light on an important but under-researched aspect of UK energy policy development and understandings of transitions. In doing so, the research makes an important novel contribution to the literature on power and energy transformation in the UK. There is clearly however scope for further research into power and UK energy transformations.

7.6 ETHICAL AND LEGAL ISSUES

This thesis has used a methodology based on interviews and includes information about the behaviour of specific individuals and companies. The research project was subject to a University Ethics Assessment. The key ethical issues were associated with the interviews themselves and the interview data.

In order to protect interviewees (and as explained previously), in advance of interviews a consent form was provided which interviewees had to read through and sign if they were to take part. The consent form described the project, explained that taking part was voluntary and that interviewees could withdraw

from the project at any time. The consent form also explained that all interview data would be held electronically on a computer and secured with password access. The form asked interviewees if they were happy to take part, if they were happy with the interview being recorded, whether their comments were attributable, anonymous or if they wished to make a mixture of attributable and anonymous comments.

The other key ethical issue associated with the project relates to the potential reputational damage that the publication of results could cause. The nature of the research means that it is inherently political and considers specific individuals and companies. The research has the potential to highlight lobbying activity, the approaches used and possibly show where individuals and companies have had successes or failures. There is of course also the potential for legal challenges under libel laws if any statements made in the thesis identify a particular actor and are damaging and untrue.

In order to minimise the risk of any legal issues, every effort has been made to ensure all statements made in the thesis precisely reflect the collected data to ensure the thesis is accurate. Referencing of interview data has been carried out as thoroughly as possible. I have also protected individuals where necessary. This has involved anonymising statements made by interviewees if their own statements could damage themselves; if, for example, the interviewee mentioned elements of their own behaviour which could be seen as questionable. This required a value judgement in some places. Where data has highlighted behaviour by certain actors which could be seen as dubious, I have only included the names of individuals and companies if it adds value to the thesis and two companies have been fully anonymised. Finally, only the company/organisational affiliation of interviewees is included in the list of interviewees in annex 2 rather than their personal name.

7.7 CHAPTER CONCLUSIONS

This chapter has described the project methodology which is designed around answering the research questions introduced in chapter 1. The first phase of the methodology used a small number of interviews with subject matter experts. As a result, the third research question was changed slightly to ensure it focused

on the role of ideas in the policy process as frames, and specifically the use of frames by actors.

The rest of the chapter has described the overall methodological approach to answer the finalised research questions which are:

1. How has UK heat generation policy been affected by the power of actors?
2. What approaches have been used by actors to attempt to affect UK heat policy?
3. Do ideas have power as frames in the heat policy process?[22]
4. How can understandings of power which emerge from this research be used to strengthen the multi-level perspective on transitions?

The project uses two case studies, firstly heat generation policy in UK and secondly heat generation policy in the Netherlands as an international comparison.

For both case studies, semi-structured interviews with key actors in the relevant heat policy network were carried out in order to understand who is active in the policy network, where there have been policy changes affected by actors and the approaches used by actors to attempt to influence policy. Interviews were carried out with actors with interests in heat policy and with actors on the receiving end of attempts to influence policy such as civil servants. The EAR instrument which is based around triangulation of data sources was used to investigate successes and failures linked to lobbying; this approach offers a repeatable and rigorous analytical methodology.

The following four chapters contain the research results and associated discussion based on the methodology described in this chapter and linked to the underlying theoretical framework. Chapter 8 focuses on if and where actors have affected UK heat policy and uses the EAR instrument for thorough triangulation. Building on the rich EAR analysis in chapter 8 and continuing to use triangulation approaches, chapters 9 and 10 consider the key actors involved and approaches used to influence respectively. Chapter 11 considers similar issues of power and heat generation policy in the Netherlands.

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[22] This is a modified version of a proposed research question which was altered following expert engagement on the subject on focus of the thesis as described in section 7.1.1.

8 UK CASE STUDY - THE DEVELOPMENT OF HEAT GENERATION POLICY IN THE UK 2003-2015 – RESULTS AND DISCUSSION SECTION 1

This chapter is the first part of the results and discussion section of this thesis. It considers where data has highlighted that power may have had an impact on actual policy changes associated with UK heat policy. Using the EAR triangulation approach described in the methodology, it considers why these changes have happened and how actors have or haven't been successful in affecting these changes.

The chapter is structured around thirteen policy episodes. There have been a significant number of heat policy changes/interventions and interviewees have provided a large number of instances where it is suggested that actors have had some power over policy change. Episodes are only included in this chapter if interviewees have explained that the power of actors has been vital in causing policy change and the actual policy change has been apparent or if grey literature has shown that a significant policy change has taken place. The EAR instrument is used to investigate power in each of these episodes.

These policy episodes are set out chronologically (although some overlap) and the overall policy timeline is shown in Figure 8-1. This chapter develops a thick narrative of power and heat policy and how it has been influenced. The following two chapters build on the episodes considering 'who' (i.e. which actors) has been attempting to have power and 'how' (i.e. which approaches) actors have attempted to use power in the policy process. Where important themes linked to other chapters have emerged, these are highlighted in the text and the reader is guided to the relevant section which considers the issue in greater detail.

Using the EAR approach, interview data detailing lobbying was triangulated with interview data from interviewees with experience of being lobbied; interview

data was also triangulated with grey literature if available. Depending on the availability of evidence, the level of triangulation possible for each episode is described in the relevant episode as 'none', 'part' or 'thorough' and this is also highlighted in the chapter summary table Table 6 on page 208.

All insights gained from interviews are referenced as follows where x represents the interview number e.g. (X). All comments from anonymous interviewees or off-the-record comments are labelled or described as such. Some comments have been anonymised in order to protect sources if the comments are seen as being potentially controversial and/or reputation damaging.

Policy episodes are also considered from the perspectives on power identified earlier. These perspectives are the 'four faces of power' approach, ideas of power over and power to and also the difference between structural or agent-based elements of power.

Elements of this chapter which focus specifically on the development of the GB Renewable Heat Incentive policy have been published elsewhere as a conference paper (Lowes, 2016) and following peer review, published in journal 'Energy Policy' (Lowes et al, 2019).
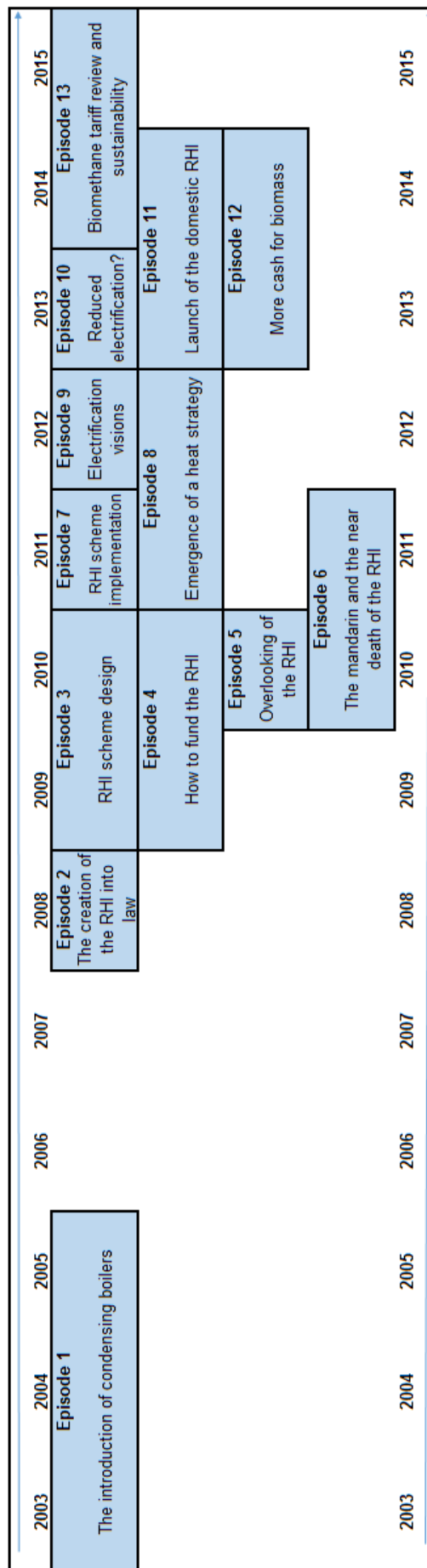
Figure 8-1. Timeline of policy episodes identified through research

8.1 POLICY EPISODE 1 - THE INTRODUCTION OF LEGISLATION MANDATING CONDENSING BOILERS (2003-2005)

The first heat policy episode highlighted from the interview data was the introduction of condensing boilers. This was a policy measure which had been proposed in the 2003 UK Energy White Paper (Department for Trade and Industry, 2003), a paper which had four key goals:

- Aiming to reduce UK greenhouse gas emission levels by 60% on 1990 levels by 2050;
- Maintaining security of energy supplies;
- Promoting competition in energy markets;
- Ensuring consumers could afford their energy bills.

The 2003 Energy White Paper did not consider the need for a wholesale transformation of the UK heat sector as has been described as necessary in section 1.2. Rather, heat was considered simply as a segment of UK energy demand and discussed in the context of energy efficiency and building regulations and this appears to be because the Government had only just introduced a policy target for decarbonisation (Department for Trade and Industry, 2003). Some of the earliest low-carbon heat market interventions, however, were being considered within this 2003 white paper. As well as discussing solar thermal systems and the development of district energy systems, the white paper explains that the Government will use building regulations *'to raise the standard required for new and replacement boilers to the level of the most efficient boiler types - A and B rated condensing boilers.'* (Department for Trade and Industry, 2003, p34). Condensing boilers increase efficiency by extracting the heat from the boiler flue gases which would otherwise be lost to the air.

The eventual mandating of condensing boilers in 2005 represented a significant challenge to the boiler market and it is recognised as being one of the most significant interventions ever in the UK heating market (17, 20) as '*it transformed the market in a very short period of time so prior to then, the minimum boiler efficiency threshold was I think 78% and it became 86% from the 1st April 2005 and the boiler market flipped over from non-condensing*

boilers to condensing boilers almost overnight with only a 2 year running period' (20).

Despite the recognised benefits of condensing boilers (Department for Trade and Industry, 2003), industry support does not appear unilateral and this policy change highlights a potential power struggle involving boiler manufacturers who would need to change their products.

A representative from Worcester Bosch, at the time a major UK boiler manufacturer and currently the UK's largest boiler manufacturer[23] (17) explained during an interview that as a company, they '*embraced*' the potential mandating of condensing boilers, describing it as '*good policy*' (17). These comments, however, may not be reliable as according to an interviewee from a heat interested trade association, '*Worcester were one of the companies, and REDACTED NAME (*name of Worcester Bosch representative*) will tell you otherwise but I was there as he was and it's not true, for the first year Worcester were the most vociferously opposed company, it was Worcester and Baxi that were opposing it most strongly for that condensing boiler regulation being brought into existence*' (20).

While these two interviewees clearly disagree, this actual opposition by Worcester Bosch and Baxi is one interviewee's word against another. A media and grey literature search has not shone any more light on this particular issue. This issue was also followed up directly with Margaret Beckett's office (Margaret Beckett is still an MP at the time was secretary of state who was responsible for and launched the condensing boiler regulations) which explained that '*unfortunately she does not recall the specifics of the policy*' (Personal communication 13/9/2018) adding no further evidence. An anonymous civil servant, however, who was involved with the regulations for condensing boilers did explain that '*the company that was probably the strongest/most vocal in its opposition was Baxi Potterton*' and that '*Worcester Bosch may have initially opposed the change but subsequently, when it became clear Government was serious, took a quieter approach*' (personal communication 27/09/2018). So, triangulation does suggest that it looks likely that boiler manufacturers Baxi and

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[23] Worcester Bosch is part of the multi-national Bosch Group

Worcester Bosch were at least initially opposed to this change although no grey literature has been identified to confirm this.

Despite this apparent resistance, the Government confirmed the introduction of the new building regulations to mandate condensing boilers at a launch event at another boiler manufacturer's (Glow-worm/Vaillant) site (DEFRA, 2003). Glow-worm/Vaillant had apparently supported the Government's plan out of the sight of the other boiler manufacturers who had been more opposed in order to prepare their own operations and gain a market advantage and this support had boosted the Government's confidence in the changes (20). The Vaillant website explains that in 2005 '*Secretary of State for Environment, Food and Rural Affairs Margaret Beckett announces new legislation for the changeover to high energy efficiency during a visit to Belper*' (where their UK manufacturing site is located) (Vaillant, 2018). Separately, the Glow worm website explains that in 2005, Glow Worm (a Vaillant brand) became '*the leading manufacturer in the switch to high efficiency boilers. This important launch is announced by Dame Margaret Beckett in Belper, Derbyshire*' (Glow Worm, 2018). Together, these comments suggest that Vaillant/Glow worm was communicating with Government, arranging the announcement of the condensing boiler legislation alongside the launch of a new boiler.

Two interviewees made unprompted comments regarding the strong will of Margaret Beckett in pushing the condensing boiler regulations through in spite of some discontent in industry (8, 20). Whilst the power of ministers is considered further in section 9.1.1.2, this policy episode represents a good example of the first face of power where an actor, the energy minister, has been able to make a change which may otherwise not have happened; another minister in the same position may not have pushed this policy change through suggesting that the minister has an element of agent based power.

Of course the power of Margaret Beckett to drive through the regulation is associated with her formal position of authority in the Government and her responsibility for a particular policy area, her power is therefore linked to more structural elements of power. It was also the case that the 2003 white paper had also put the issue onto the policy agenda and there was therefore a temporal element to this policy and the policy idea was already 'in play'. The Government had previously used its power to put this policy on the agenda (i.e. the second

face of power). While certain boiler manufacturers are alleged to have attempted to stop this change from happening, if these attempts did happen, they clearly failed, indicating a potential lack of power. Overall then, this first policy episode indicates a power struggle and also highlights the power of the Government and ministers to drive policy through different faces of power.

'Part' triangulation in this episode is possible. The episode highlights the difficulties of triangulating data using the EAR approach when certain data such as grey literature or the view of the person being lobbied is not available.

From 2005 onwards for gas, and from 2007 onwards for oil, all new boilers fitted in England and Wales need to be able to operate in condensing mode (similar regulations cover Scotland and Northern Ireland) (DECC, 2013k). There were 9.3 million condensing boilers operating in the UK in 2015; this is 2.5 million installations ahead of the Committee on Climate Change's indicator trajectory for meeting the UK carbon target suggesting[24] a significant carbon saving (Committee on Climate Change, 2015).

8.2 POLICY EPISODE 2 - THE CREATION OF THE RENEWABLE HEAT INCENTIVE IN LAW (2008)

This policy episode considers the introduction of the legislation that underpins the Renewable Heat Incentive and investigates the power that drove its inclusion in the 2008 Energy Act, where the Government at the time had not initially expected it to be located.

During 2008, the 2008 Energy Bill was passing through Parliament and civil servants from BERR were working to ensure the Government's important energy policy areas were being maintained in the bill. One of these areas included the introduction of so-called 'banding' for the 'renewables obligation' scheme which was aiming to introduce differentiated levels of support for different large scale renewable electricity generation technologies (26).

There was support among parliamentarians for the development of a feed-in-tariff mechanism to support smaller scale renewable electricity generation,

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[24] In order to work efficiently in condensing mode, the water return temperature on a condensing boiler must be below 55 degrees. However, many boilers are set higher than this meaning the actual efficiency savings may be limited (YouGen, 2012)

something which was not in the bill at this point (26). This support was officially set down in an Early Day Motion[25] tabled on the 5th February 2008, shortly after the Energy Bill entered Parliament; this Early Day Motion had the support of 281 MPs (Parliament, 2008c) representing a significant proportion of the 646 MPs at the time (Rallings and Thrasher, 2005).

In April 2008, Alan Simpson MP who laid the Early Day Motion, along with a number of other MPs laid a potential amendment to the 2008 Energy Act; this amendment would have caused the Government to introduce a Feed in Tariff system which would have supported small scale electricity and heat (26, and Parliament, 2008a). Whilst the amendment was voted down (210 votes for and 250 against) (Parliament, 2008e), this vote represented a significant rebellion by the Government's MPs as 33 Labour MPs voted in favour of the amendment (Guardian, 2008b).

The Government was concerned that the level of political support for the Feed in Tariff policy would eventually lead to a defeat in the Commons, which would be a major embarrassment. They therefore decided that rather than risk defeat, they would take the opportunity and develop a Government amendment which would create the Feed in Tariff and also lay the primary legislation for a Renewable Heat Incentive (26). In the words of one interviewee, Parliament '*forced the Government's hand*' (32). The amendments for both the Feed in Tariff and the Renewable Heat Incentive were introduced to the bill on 5th November 2008 at third reading in the House of Lords, the latest stage amendments can be introduced (Parliament, 2008f).

Because of their late introduction and the limited time to debate them, the amendments were not contested and the bill received Royal Assent on 26th November (26). '*The primary legislation, it wasn't perfect and we knew, we knew it wasn't perfect because we ended up having something like two months when you normally have like six months to a year to define primary legislation, it literally was about two months and we had people working round the clock literally just do that, so that amendment went in, it got passed again partly*

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[25] 'Early Day Motions' are a method for members of parliament to raise important issues and gather the support of other members

because the bill was so far down the track that nobody really wanted to disrupt it and then the bill got passed so it gave us the RHI' (26).

Whilst the wording of the amendment was written by officials working in the newly created Department of Energy and Climate Change (DECC) (26), the driver to instigate the RHI at that time appears to come from Parliament and there are a number of different opinions on who caused the RHI to come into legal existence when it did. The Renewable Energy Association (REA), a trade body representing renewable energy companies, explained that they believed they, along with Friends of the Earth, a non-governmental organisation had been primarily responsible for the RHI through their efforts lobbying MPs or in their words, '*instrumental in getting that*' (14) and this was also repeated by other previous employees including their ex-chief executive (7, 11):

> *'Interviewee: the whole of that Feed in Tariff and the RHI existence was the big win. That was the first big goal.*
>
> *RL: And do you think that's the REA?*
>
> *Interviewee: I really do yeah, because we got that campaign with the academics and the NGOs, we got that diverted onto a more constructive path which was not just electricity and was not just rip the RO up and have Feed in Tariffs in place, have tariffs for heat and small scale and gas and we did lobby for it.' (7).*

Use of the EAR triangulation method corroborates the REA's (the 'ego's) story; two civil servants (representing the 'alters') working on the RHI as the legislation developed explained that the REA played the leading role in terms of political campaigning for the RHI (26, 29). One civil servant explained:

> *'that was definite lobbying with, my recollection is with the REA who really drove that and then the REA drove the amendment and everyone coalesced behind the REA including the Micropower Council[26]' (26).*

Another civil servant explained:

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[26] The Micropower Council is a trade association which has since become the Sustainable Energy Association

'they were a big force certainly, even just to get the legislation in
so she [Ex REA Chief Executive] was a big force and I think
probably on Feed in Tariffs as well so I think, it's fair to say we
dealt with the REA the most throughout and again they could
corral the right people into a room…the REA were the biggest sort
of influence' (29)

Other sources also mention the role of Environmental NGO Friends of the Earth
(32), and while Friends of the Earth spearheaded the campaign, it was
(according to a Friends of the Earth ex-employee) initially the Renewable
Energy Association who had suggested that heat was included as part of the
original amendment (52), which rather than using the word 'electricity' used the
word 'energy' therefore including heat (Parliament, 2008b). Friends of the Earth
continued campaigning on the issue as the bill passed through Parliament and
most notably coordinated a joint letter with various academic and industry
actors which was sent to members of parliament and received media attention
(Guardian, 2008a). This letter represents grey literature indicating that Friends
of the Earth were indeed active with regards to this policy change.

An ex-employee of the Micropower Council, a trade body specialising in micro-
generation explained that he believed that the Micropower Council had been
important for the emergence of the RHI (20). Using the EAR triangulation
approach, whilst the role of the Micropower Council was recognised by civil
servants involved in the RHI, it was suggested that its impact was less
significant than that of the REA (26, 29). No grey literature identified has
suggested that the Micropower Council had a significant role in this policy
development.

While most of the interviewees from industry who had been involved with the
campaign to introduce the RHI suggested that industry had played an important
role in driving the introduction of the RHI legislation, one interviewee suggested
that even though the campaign led by the REA and Friends of the Earth did
support the RHI's development, the RHI probably would have happened
anyway, it simply happened sooner, in advance of the 2010 general election
(11). This view is supported by the words of a DECC civil servant, '*we thought*
this is a fantastic opportunity to get some primary legislation in around a

renewable heat incentive' (26) and this follows from the fact that the Government was already discussing introducing support for renewable heat.

It is, of course, impossible to know if this legislation would have ever been introduced or what the policy would have looked like if it wasn't included in the 2008 Energy Act. Policy episode 4 which considers the funding of the RHI suggests that the RHI may not have been funded by the 2010 to 2015 coalition Government without strong-willed politicians and perhaps the existence of legislation gave momentum to the eventual funding of the RHI by the coalition Government. The development of the Energy Act was also taking place in the context of the UK agreeing the EU 2020 climate and energy package part of which required 15% of the UK's energy from renewable sources by 2020 (EU Commission, 2018). Wider developments may therefore also have had some impact on the voting preferences of MPs. Overall, however, it does appear that lobbying did drive the specific inclusion of the RHI in the 2008 Energy Act and 'thorough' triangulation has been possible for this episode.

Applying the faces of power model to this example shows the importance of the first face of power. The REA and associated organisations appear to have induced the Government to do something that they would have otherwise not done, i.e. the amendment for the RHI and the Feed in Tariff. This change also suggests the role of the second face of power, with parliamentarians alongside the REA having the power to have heat put on the agenda in the Early Day Motion and the original amendment. The third face of power, the shaping of preferences can also possibly be observed, with the development of a joint letter by renewable energy interests promoting the issue of small-scale renewables in the media attempting to pressure MPs to vote for an amendment to the Energy Act. This campaign was about shaping the preferences of MPs to get them to support the idea of a Feed in Tariff and support for small scale renewable energy production.

As with the previous episode, clearly in this example, the power of MPs and indeed lobby groups exists in a structural context with MPs having the ability to do things such as lay Early Day Motions and trade associations and charities with access to finance to pay for engagement and advocacy work. It also appears in this episode that there is an element of intransitive power (joining forces to have power) with organisations such as Friends of the Earth, The

Renewable Energy Association and academics joining together on the campaign to support the addition of the FIT and the RHI to the Energy Act. Overall, the EAR approach does in this example suggest that actors have had power to cause the introduction of the RHI (and Feed in Tariff) legislation into the 2008 Energy Act.

8.3 POLICY EPISODE 3 - RHI SCHEME DESIGN (2009-2010)

This policy episode considers the power behind the development of the tariff structure for the RHI which one organisation believes they influenced significantly.

In February 2010, DECC released a full consultation into the RHI which explained its thoughts on what types of renewable heat the scheme would support and how projects would be rewarded (DECC, 2010c). The approach to setting tariffs for the RHI scheme proposed that payments would be '*calculated to bridge the financial gap between the cost of conventional and renewable heat systems at all scales, with additional compensation for certain technologies for an element of the non-financial cost (e.g. the inconvenience of digging up a garden to install a ground source heat pump)*' (DECC, 2010a, p3). This, in practice, would be expected to mean that a person installing a renewable heat system would be fully compensated for any additional costs compared to a fossil fuel system and would make a financial return on the additional investment.

Two interviewees associated with a particular trade association, The Micropower Council, suggested that they had been directly involved in this financial aspect of the scheme design and that a paper had been prepared by their organisation at the time which formed the basis of this particular aspect of the scheme (20 and anonymous quote). If this is the case, then the interviewees could be seen to have had power over the RHI policy design process. One of them explained; '*We actually wrote the original blueprint that suggested that the tariffs of the incentives at least should be calibrated to cover the difference in costs between a fossil fuel system and the renewable system that you're trying to promote (20)*' and the other explained that they were '*intimately*' involved (anonymous quote).

When asked about the importance of this particular trade association paper, the lead civil servant on the RHI at the time (representing the alter using the EAR approach) explained: '*I don't recollect that at all because we had a really good guy who's now gone to the private sector who was our tariff kind of expert…so the tariff structure was based on an internal discussion saying how easy and simple can we make this and so then a decision was taken*' (26). If this is believed, this suggests that the role of the trade association mentioned above was significantly less than they themselves suggested and actually the same outcome would have come about without their engagement. In order to fully triangulate the interview data with grey literature, the paper sent by the Micro Power Council to DECC was located (available from author on request). This paper does contain suggestions on the shape of the RHI with regards to how payments should be made and how the scheme should be funded. While the paper explains that payments should be based on 'gross renewable heat' produced, however, the paper contains no mention that tariffs should be based on the difference between renewable and fossil fuel system costs and there is therefore no evidence that the Micro Power Council did have any power over this policy detail.

It's interesting to note that the off-the-record interviewee discussed above who mentioned intimate levels of involvement within this policy episode also noted the general importance of the role of luck in lobbying. He suggested in relation to this perceived lobbying win: '*I mean that was an example of success but it's also luck, lobbying is half luck, half chance. More than that probably.*' While this interviewee believed they were lucky to be so '*intimately*' involved in the policy process, the evidence does not suggest that it was their lobbying efforts which caused the policy tariff setting methodology to be designed in the way it was. The availability of evidence means that level of triangulation possible in this episode has been 'thorough'.

In indicating a lack of power, this policy episode shows that the triangulation process can be very useful for investigating lobbying as, it appears that a lobbyists comments may not reflect actual policy change. While the lobbyist in this example believed that they had the first face of power over the Government, they do not appear to have had any actual power. It should of course be noted that the lobbyists may have had power but the civil servant did

not want to admit this. Because of the apparent lack of lobbying success identified, it is not possible to identify the existence of a specific face of power in this episode. The Micro Power Council, however, believed they had power over (the first face of power) the Government to shape the policy in a particular way and it appears that their close working relationship with civil servants meant that they may have exercised the second face of power and get their RHI paper and some of their recommendations on the policy agenda.

8.4 POLICY EPISODE 4 – HOW TO FUND THE RHI (2009-2010)

This policy episode considers the decision around how the RHI was going to be funded and the potential power associated with this decision.

As discussions regarding the operation of the RHI were taking place, concurrently, discussions concerning the funding of the policy were also taking place. Shortly after the 2008 Energy Act received Royal Assent (becoming law), the February 2009 Heat and Energy Saving Strategy Consultation maintained the Government's view that '*Funding for the RHI will come from a levy on suppliers of fossil fuels for heating'* (DECC/DCLG, 2009, p60). The 2008 Energy Act allowed for the scheme to be either central Government funded (e.g. taxes or Government borrowing) or funded by '*designated fossil fuel suppliers*' (Parliament, 2008d). The February 2010 RHI consultation into the running of the RHI scheme, however, explained that DECC was considering changing how the scheme was going to be funded following informal consultation with industry (DECC, 2010c).

The consultation explained that the Government had met with and heard from a number of organisations who might be liable to meet the costs of the RHI and recognised the problems with funding the scheme through fossil fuel suppliers: '*The Government has listened to the concerns of stakeholders about some of the potential practical problems of implementing a new levy equitably, transparently and efficiently*' (DECC, 2010a, p13). The consultation document didn't however explain in any detail what the specifics of these issues were. The question of this policy episode is therefore, did any actors cause this change to how the RHI was funded?

Representing the 'ego' in the EAR approach, a representative from an off-grid fossil fuel company, referred to from now on throughout the thesis as 'company

A'[27], explained explicitly '*We lobbied very hard that the RHI should come from general taxation, not from a levy on fuel bills and it came from general taxation, how much we had to do with that I don't know, but that was certainly our line'* (16).

Confirming this lobbying, one interviewee from Government explained that the same off-gas-grid company had been lobbying to ensure that their product wasn't covered by the RHI revenue raising as this could increase fuel poverty for their consumers (by pushing up prices of the relevant fuel); they had also been suggesting that this could be complicated to administer for people who buy the fossil fuel product for various uses such as barbecues (26). Grey literature confirms that the view of the company 'A' was that the RHI should have been funded through general taxation with a report funded by the company (carried out by the so-called 'Renewable Energy Foundation' through their consultancy arm) stating that '*it appears to us that general taxation is the most transparent, and the least likely to have unforeseen consequences'* (reference not included to maintain anonymity).

But it was not just this company who appear supportive of the scheme not being funded via a levy on fossil fuels. According to a civil servant in DECC working on the RHI at the time, whilst the 'Big 6' companies were generally supportive of the RHI, '*off-the-record they would say we might stomach it for a while but eventually we will not, we will challenge you because it just doesn't make sense that we get a levy on us'* (29). The potential approach of a levy on fossil fuels supposedly didn't '*make sense'* because if the RHI covered only the Big 6 suppliers and was levied on gas bills as it was expected to be for reasons of simplicity, gas consumers would be penalised but other fuels such as electricity, coal, oil and bottled gas would not be penalised even though they are more carbon intensive than gas.

Clearly, in this instance, 'thorough' triangulation confirms that lobbying from the fossil fuel sector was felt by DECC and this lobbying was attempting to ensure that the RHI was not funded from fossil fuels. It was, however, explained by a civil servant that the development of a system to fund the RHI through energy

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[27] This company has been anonymised to protect both the interviewee and eliminate the potential of reputational damage to the company in question.

suppliers would have been incredibly complex and long-winded and funding it through taxation would be a simpler option (26). So, while triangulation shows that elements of industry were supportive of the RHI not being funded through fossil fuels, triangulation does not show that industry lobbying caused the RHI to be funded from Government spending. As such, no faces of power can be recognised in this episode.

This episode, again, highlights the difficulties of measuring power and highlights another example of a lobbyist lobbying in a particular way and policy change suiting them. It is however unclear if their behaviour caused the change. Specifically, this example shows the key methodological issue with so-called 'preference attainment methods' (considered in section 7.4.2) which are sometimes used to analyse lobbying. While the outcome matches the lobbyist's desires (i.e. their preference is attained which suggests success using the preference attainment approach), it cannot be determined that the lobbyist actually caused the outcome meaning that this approach would provide a false positive in this example. This episode also once again highlights the various factors other than lobbying which can cause policy change such as administrative issues (i.e. the ease of funding the scheme from Government spending compared to a levy) highlighting the importance of the context of power and combinations of different factors in the policy process.

8.5 POLICY EPISODE 5 - THE BRIEF OVERLOOKING OF THE RHI (2010)

Following the election of the Conservative/Liberal Democrat coalition Government in May 2010, neither the initial 'Coalition Agreement' (HM Government, 2010) nor the first budget of the new Government in June 2010 contained any mention of the RHI (HM Treasury, 2010a) suggesting that the policy was a low political priority. There was nothing to provide any certainty to the low-carbon heating industry that the policy would ever actually open to participants. It was not until the Spending Review in October and once departmental budgets had been set that the Government would announce that funding would be made available for the RHI (HM Treasury, 2010b).

While no announcements were made by DECC before the Treasury announcement, according to one interviewee working at DECC, the policy did have some strong political support within DECC, '*I think the words Chris Huhne*

(secretary of state for DECC at the time) *used were: 'it's there in invisible ink*"
(29). It was also the case that the DECC ministers at the time, Conservatives
Charles Hendry and Gregory Barker, had been in opposition as the 2008
Energy Act passed through parliament and had supported the early amendment
to introduce small scale renewable heat and electricity support (Parliament,
2008d, discussed in policy episode 2) suggesting that they were in favour of the
Feed in Tariff and the RHI. The DECC ministers were also considered
supportive of green policies in general and DECC was seen as the most '*left
and green*' department (29). No grey literature, however, has been discovered
which provides any detail of the commitment to fund the RHI and so only
interviewee comments from the civil servant can be used.

As well as the internal political support, another interviewee also explained that
there was lobbying of both DECC and the Treasury by external organisations
including some supply companies to ensure that the RHI did go ahead in
advance of the release of the spending review (26), however, a literature search
has not highlighted any evidence of this either.

Continuity of ministerial and departmental support for the RHI through the
change in Government is a significant policy outcome particularly as the
Government was at the time targeting major reductions in Government
spending (HM Treasury, 2010b). Attributing this outcome to a specific actor,
however, is not possible because of the limited evidence; triangulation is not
possible in this case. This episode highlights the potential power of an actor
who is not a lobbyist but who is within Government. In this case, using the EAR
instrument, the DECC ministers, despite being inside Government, could be
seen as the 'egos', attempting to lobby their own Government (the Treasury) for
funding. It is also the case that in this situation, 'egos' from industry were
attempting to influence the policy from outside Government. Again, this example
highlights the complexity of power with various actors attempting to have power
at the same time though not necessarily working together. The specific issue of
the political power of ministers and power within Government has emerged as
an important theme in the research and is explored more fully in section 9.1.1.2.

Grey literature, including the spending review document which announces the
RHI funding, simply explains that the RHI is being introduced in order to help
the UK meet its EU renewable energy targets (HM Treasury, 2010b) while

providing no further evidence on the reasons for this policy development. The lack of evidence also means that evaluating the type of power at play is not easy. It is possible that the minister, in getting funding from the Treasury for the RHI, had power over the Government (the first face) but it is also possible that more structural elements of power such as the existence of the EU Renewable Energy Directive also drove this change. It may also be that because both DECC and external organisations were lobbying for the funding of the RHI, an element of intransitive power, with organisations coming together, had some policy impact.

8.6 POLICY EPISODE 6 - THE MANDARIN AND THE NEAR DEATH OF THE RHI (2010-2011)

This policy episode considers changes to the format of the RHI which meant that the domestic element of the scheme was delayed and overall the scheme was targeted more towards a goal of cost-effectiveness. The episode shows that it appears one civil servant in particular had power over this policy change.

Despite clear political and industry support, the existence of underpinning laws and the agreement of finance from the Treasury at a time of Government austerity, one major obstacle to the RHI remained in the form of the permanent secretary in DECC, the most senior civil servant in the energy department. As well as leading a department, the permanent secretary is also normally a department's accounting officer who is the person accountable to Parliament for the allocation of public money (HM Treasury, 2015). This structure highlights just one example of the institutional nature of power in policy making and the various contextual issues which can combine to complicate the policy process. The permanent secretary leads the department responsible for decarbonisation but also has personal responsibility for ensuring all money spent is demonstrably of value.

Two interviewees explained that at the time of the RHI's potential introduction, the permanent secretary who was also the accounting officer, was opposed to the RHI (off-the-record and 28). Other interviewees explained that in fact the most negative comments regarding the RHI came from within DECC because there was a concern that the rapid increase in spending caused by the Feed in Tariffs for electricity would be replicated with the RHI (26, 28, 29).

As explained in a non-attributable comment:

> *'after the minister said yes, and we got Chris Huhne to say yes go ahead with the RHI our permanent secretary got involved … we had a process, a process called the internal approvals committee and it is basically a group of very senior people within the department that is meant to look at all the big projects we undertake in DECC and make sure they're value for money.*

> *I mean it's a good process, it's a robust challenging process to make sure you've thought of everything in terms of your policy, so they feel comfortable as accounting officer that something's going through and she was very very uncomfortable with what was happening on the RHI to the point that it was being held back, even after the announcement in the spending review she didn't want it to go ahead in April 2011' (anonymous).*

The RHI was recognised as being both a large amount of spend in general and an expensive way of reducing carbon emissions and one civil servant explained:

> *'we'd been honest that if we were not being driven by the EU 2020 targets we wouldn't have designed it the way we did, it was designed purely to meet that 2020 target.*

> *If you were looking at something purely on low-carbon terms you probably wouldn't have done it like that, in fact we wouldn't have done it like that and it was hugely expensive, we knew that' (anonymous).*

This particular quote indicates the power of targets and goals to drive policy. With the EU 2020 target of 15% of all UK energy to come from renewable sources by 2020, it was clear that policy was required to increase 2011 renewable heat levels from 1.5% of all demand (DECC, 2011d). The civil servant quoted suggested, however, that a policy approach focused primarily on reducing emissions from heat rather than promoting renewable heat would have been more cost effective. The issue of targets and goals is considered in more detail in section 10.2.3. The issue of renewables versus carbon saving is also

recognised as being an important issue and is discussed in further detail in section 10.2.2, the technicalities of this issues are also considered in annex 5.

At one point, the issue of whether or not the RHI would ever be introduced was almost elevated to a level where the permanent secretary was going to request a so-called 'ministerial direction' for the policy to progress (28). A ministerial direction is requested by a permanent secretary if a minister or secretary of state wants to go against the advice of their accounting officer and that minister then becomes accountable to parliament for that issue (HM Treasury, 2015). A ministerial direction indicates that a Government department is not supportive of a policy and it is being promoted by a minister and at the minister's risk. In practice this could mean the minister being called to give evidence regarding the policy to select committees or called to Parliament without the support of their department. According to analysis by the Institute for Government, only two requests for ministerial directions were issued during the coalition Government (2010-2015) making them an unusual occurrence (Institute for Government, 2015).

The ministerial direction on the RHI, however, was never issued because of a compromise between the permanent secretary and Chris Huhne which meant that at first only the non-domestic element of the scheme would progress (28). The larger scale renewable heat systems were shown to have some financial benefits under Government accounting rules, based on the net present value of the policy, whereas domestic scale systems did not have a recognised financial benefit (anonymous).

Similarly to the previous example, this policy change primarily concerns administrative (i.e. within Government) power struggles. In this case, from a triangulation perspective, the 'ego' is the permanent secretary and is attempting (apparently successfully) to stop or slow the RHI policy and the 'alters' are the department's own ministers. Whilst only 'part' triangulation of the data sources in this example is possible because of the internal nature of the issue, it appears, based on interviews with civil servants that the permanent secretary did exercise power to limit the initial scale of the RHI. It is also clear that this policy change did happen as the RHI is now run as separate domestic and non-domestic scheme.

From the faces of power perspective, in this example, the permanent secretary, through the first face of power, had power over the ministers to cause the RHI policy to be modified so that only the non-domestic scheme initially progressed. While the permanent secretary was able to have power in this situation, this power was clearly related to the formal authority of her role. She was both in charge of the department and held responsibility for all DECC departmental spending. As such, while we can ascribe this policy change to the first face of power, in doing so it is important to recognise the institutional context in which this power was exercised and this example again highlights the importance of structural power in the policy making process. This episode also again highlights the difficulties of analysing power with no grey literature available and an almost total reliance on limited interview data. Further primary interview data could (but may not necessarily) provide additional evidence around this policy change but the limits of this research mean that this is not possible within this project. This episode highlights the potential level of detail of analysis that can be required to understand the power behind just one element of change in a policy development process.

8.7 POLICY EPISODE 7 - RHI SCHEME IMPLEMENTATION (2011)

This policy episode considers the initial implementation of the non-domestic element of the RHI and the changes made to non-domestic tariffs from the previously proposed levels. It considers whether these changes were affected by the power of industry actors.

The Labour Government released a consultation into the structure and operations of the RHI in February 2010 (before policy episodes 5 and 6). Following the consultation, a new (coalition) Government was elected, and as described previously, the RHI had its funding agreed but was expected to be initially limited in scope to a non-domestic scheme.

Following these events, the official response to the February 2010 consultation was released in March 2011 by the then Conservative/Liberal Democrat coalition Government (DECC, 2011c). The consultation explained that initially only the non-domestic scheme would be taken forward (though included no mention of the power struggle described in the previous section), however domestic renewable heat systems would be supported by an interim grant

scheme (The Renewable Heat Premium Payment discussed in section 2.4.2.2) in the short term and a longer term scheme would be further developed to support domestic systems (DECC, 2011c). The consultation document also explained that the non-domestic scheme would also not include certain technologies which had been included in the consultation; bio-liquids were initially excluded because of concerns over competition for bio-resource and air source heat pumps were also not included apparently because of uncertainty over costs (DECC, 2011c).

The consultation document also included the tariffs which non-domestic renewable heat installations which were to be supported would receive under the RHI. The changes to the tariffs between the initial 2010 consultation and the Government's 2011 response affected not just the prices renewable heat would receive per unit but also the length of time the tariff would apply for and made changes to the tariff that different installation sizes would receive (DECC, 2011c) (the tariffs from the 2010 consultation document are shown in annex 4 and the tariffs for non-domestic heat when the scheme was introduced are shown in Table 1 on page 47).

DECC explain in their consultation response that in order to increase the cost effectiveness of the scheme, a 'strengthening' of the tariffs for large biomass and large ground source heat pump systems had taken place. They suggested the delivery of a greater proportion of these systems and greater proportion of non-domestic systems in general could increase the overall cost effectiveness of the scheme. Heat from these technologies is cheaper per megawatt hour than from others and producing heat at a larger non-domestic scale was also seen as more cost effective (DECC, 2011c). The DECC impact assessment for the RHI explains that tariffs were also updated to take account of updated cost information which had been collated by consultants AEA (DECC, 2011d; AEA, 2011).

Directly comparing tariffs between the consultation document and the Government's response is complex because of the combination of changes; for biomass systems it is particularly complex because of the combination of altered tariffs, altered tariff time-scales, altered installation size thresholds and

the introduction of a 'tiered'[28] approach for biomass. Some simple observations, however, regarding the changes to the tariffs between the original consultation and the Government response can however be made. Overall:

- The biomethane tariff was approximately doubled;
- The solar thermal tariff was halved;
- The large biomass tariff was increased by approximately 25% (this would be less in cash flow terms if discounting was used);
- It is not possible to easily compare the small and medium biomass tariffs but the underlying capital costs of biomass boilers was increased which would have led to a slight increase in tariffs;
- The large ground source heat pump tariff was doubled. For smaller ground source heat pumps because of the changing tariff bands, some medium heat pumps would see an increase and some a decrease in tariff.

These changes in tariffs represent a significant policy shift, offering greater levels of support for specific technologies than had previously been envisaged and reducing financial support for solar thermal. As with the previous episode, this change is according to DECC primarily an attempt to increase cost-effectiveness of the scheme (DECC, 2011c).

No evidence emerged from interviews which suggested that lobbying by private sector actors had caused these changes and it appears, based on the consultation response, that the power to drive this change came from Government and also links to updated technology cost data. It appears highly likely that this change can be associated with the previous episode which also saw elements of Government drive the initial phase of the RHI towards the delivery of cheaper low carbon heat.

Triangulation of sources using the EAR instrument is not possible for this policy episode because the key evidence of this policy change is grey Government literature (DECC, 2011d and DECC, 2011e). Nonetheless, this policy episode highlights the power of Government (or parts of it) to act decisively and make

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[28] Tiering was briefly described previously in section 2.4.2 and is a mechanism to attempt to equalise levels of financial return across different sizes of renewable heat installations

significant policy changes. Despite consulting on the scheme, the Department (or certainly some people within it) decided that they would significantly increase tariffs for large ground source heat pumps and large biomass systems and halved the solar thermal tariff, all for reasons of cost-effectiveness. While this may indeed have made the scheme more cost-effective, at the same time it reduced the potential for solar thermal technologies and increased the expected role for bio-energy (biomass and biomethane). While in the original analysis of the RHI scheme, solar thermal was only expected to be a small proportion of heat supported under the RHI, around 3.5% (NERA, 2010)), the updated impact assessment explained that solar thermal would make up only around 0% (rounded in source document) of heat delivered by the non-domestic scheme (DECC, 2011d). Recent RHI deployment data shoes that solar thermal represents approximately 0.17% (rounded to 2 decimal places) of the total heat delivered under the domestic and non-domestic RHI combined up to December 2018 (BEIS, 2018h).

This episode again highlights the power of Government to make major policy changes which can have significant impacts, in this case of the deployment of solar thermal technologies. This episode also highlights the structural context of power, the Government was able to make this change with no apparent opposition using what appears to be the first face of power. It appears that structural power is very important here giving both DECC the ability to make this significant policy change and also in driving this policy change as a result of a departmental focus on delivering cheaper renewable heat. This episode shows that the EAR instrument may not be suitable for highlighting all elements of power. In this case, the reasons for these significant policy changes have been highlighted from relevant grey literature showing how important non-interview evidence may be for understanding on power and policy change.

8.8 POLICY EPISODE 8 - THE INCREASING IMPORTANCE OF HEAT IN GOVERNMENT AND THE EMERGENCE OF A HEAT STRATEGY (2011-2012)

In 2011, the regulations underpinning the RHI were accepted and laid in parliament and the Renewable Heat Premium Payment and the non-domestic RHI opened to applicants later that year (DECC, 2015a). It was expected that

the full tariff based domestic RHI would open in 2012 (DECC, 2011c). During 2011, a reorganisation within DECC meant that issues to do with heat and industry became a full directorate; in the past, heat issues had not been considered on a standalone basis but had been primarily linked to energy efficiency and buildings (DECC, 2011a). This reorganisation within DECC represented a significant institutional change concerning heat policy issues and raised the profile of heat as an issue within government.

Following these institutional changes, in March 2012, DECC released 'The Future of Heating: A strategic framework for low-carbon heat in the UK' which was considered in section 2.3.2. Based on energy system modelling which took carbon emission constraints into account, this document proposed radical changes to the UK's heat system including a near elimination of gas heating which would be replaced by district heating and forms of electric heat.

Two interviewees who had at the time been working at a trade association interested in heat (4, 19) suggested that their engagement with DECC and the Treasury had been very important for influencing the development of the heat directorate, the appointment of David Wagstaff (who was at this time responsible for heat strategy work in DECC) and the production of the heat strategy 'Strategic Framework' document:

> Interviewee 4: 'Do you know why we have a heat strategy? Do you know where it came from? So it came from us.'
>
> RL: 'CHPA at the time?'
>
> Interviewee 4: 'Yeah, it really did, this is not me overblowing our trumpet, and it came from the Treasury'.

In this example, the ego (i.e. the one looking to influence policy in the EAR instrument) is suggesting that they had power to cause DECC to become much more focused on policy development work associated with heat. The interviewee went on to explain that in their discussions with the Treasury regarding the impact of the introduction of a carbon floor price[29] on combined heat and power systems, the issue of heat policy had been raised and the ego

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[29] This policy measure was introduced during the UK Electricity Market Reform process to maintain a minimum carbon price for electricity generators (DECC, 2010b)

explained to the Treasury that there was no current policy for heat. According to the interviewee, following the meeting, the Treasury then forced DECC to consider the heat issue and produce a heat strategy, in order to develop policy in this area.

Grey literature, in this case the Treasury's response to this Carbon Floor Price consultation, explains that: '*DECC will also continue its discussions with industry over the summer as part of the development of the Government's long-term plans for CHP and for heat supply overall*' (HM Treasury, 2011, p10). So clearly the Treasury had some interest in the issue of heat. However, DECC had been working on heat well before these discussions between the Treasury the trade association in question and, albeit in a different directorate, David Wagstaff had been in the post of 'Deputy Director in charge of Distributed Energy & Heat' since August 2010 (personal communication with David Wagstaff 5th April 2016 who can be seen as alter under the EAR approach).

While the increasing recognition of the importance of heat in the UK Government represents an important development associated with UK heat policy, using the EAR approach and with 'part' triangulation, the influence of actors on this change is not apparent. Similarly to policy episode 3, this policy episode highlights an example of an actor explaining in interview that they believed they had influence but, triangulation does not confirm this influence. As this episode has not identified the power of a particular actor, it is not possible to highlight any particular elements of power in this episode.

8.9 POLICY EPISODE 9 - THE ELECTRIFICATION VISION (2012)

As explained in the previous episode and in section 2.3, the idea of the electrification of heat as a key route to decarbonisation has clearly emerged. A number of interviewees from trade associations or consultancies involved in heat believed that the role of industry had been significant in driving the UK heat strategy documents down the path of a much more electric future for heat (9, 11, 19, 25, 31). Specifically, interviewees suggested that proponents of electrification included the heat pump industry (11) and large integrated energy company, EDF (19, 25). If actors did indeed drive the UK's vision for heat decarbonisation down the route of electrification, this would represent an

important element of actor power in UK heat policy. Triangulation of data, however, does not confirm this is necessarily the case.

Both interviewees commenting on EDF were reporting second hand information around the scale of EDF's Government engagement, such as its political activities and the use of staff secondments into DECC. They had not, however, seen EDF acting this way first hand. Freedom of Information request data does indeed show that EDF had a member of staff seconded to DECC between November 2008 to April 2010 and from November 2010 to May 2010 (DECC, 2013h). There is however no evidence that these particular secondees were working on anything to do with heat.

When asked whether the comments about EDF were true, the civil servant leading on the heat strategy (an alter under the EAR approach) replied simply '*nope*' (24) and suggested that the 2012 'Meeting the Challenge' document was actually about testing the electrification paradigm (24). An interviewee from EDF did not give anything away on the issue: '*Umm, you never know your own individual roles, I'd rather talk about the policy more generally*' (18). The Government summary of responses to the 2012 heat strategy document explains that EDF did indeed respond but does not give the detail of specific responses. EDF provided me with a copy of their response to the Government's 2012 consultation into their 'strategic framework for heat' and this response was indeed supportive of the electrification of heat using heat pumps and opposed to the growth of heat networks and the continued use of gas as a heating fuel (Personal Communication with Policy Manager, EDF, 3/1/2018). However, despite a belief among some interviewees about the success and political power of EDF to drive the electrification vision, based on triangulation, the data shows no compelling evidence of EDF actually having any impact on the development of the heat electrification vision.

Interestingly, this policy episode gives an example of where interviewees highlighted the perceived power of other interests rather than comments coming from 'egos' themselves. While EDF were not shown to have power in this example, the example suggests that there may be value in considering perceptions of other actors alongside the EAR instrument to gain a wider view of power.

The heat pump industry was also seen as being successful in driving the electrification vision. However, a representative from a heat pump trade association mentioned that in fact they believed the potential numbers of heat pumps proposed in the heat strategy document was '*humongous…and potentially so great they could be damaging*' because of the rapid scale of growth implied in the energy system scenarios; they did not believe this level of electrification was being driven by the heat pump industry (31). Again, the EAR approach does not show that the heat pump industry did have power over this policy change as even the egos themselves deny causing the change.

A number of interviewees also believed that David MacKay, previous chief scientific advisor at DECC (2009-2015), had had a significant impact on the electrification direction of the heat strategy (17, 21, 25, 31). As two different sources explain:

> '*Anonymous: Does one name keep coming up? A certain professor whose malign influence affects all energy and climate change policy*
>
> *RL: Not one professor, who are you thinking of?*
>
> *Anonymous: MacKay, if you're looking at the heat strategy in particular that's pretty much written to MacKay's prescription by the Climate Change Committee*' (source protected)

While this source suggests MacKay has been influential, it is not clear why they refer to The Committee on Climate Change, it was after all DECC who developed the heat strategy and who David MacKay advised.

The second source explained:

> '*Professor MacKay latched onto that [electrification] and thought that was a panacea to decarbonising heat*' (source protected)

David MacKay was clearly supportive of heat pumps even before starting his Chief Scientific advisor role at DECC. In his well-known book 'Sustainable Energy-Without the Hot Air', MacKay explains that even replacing a gas boiler with an air source heat pump fuelled by electricity from a gas combined cycled turbine electricity plant would be a more efficient use of gas (MacKay, 2009). In his book he goes on to say, '*Not forgetting the low-hanging fruit – building-*

insulation and thermostat shenanigans – we should replace all our fossil-fuel heaters with electric-powered heat pumps' (MacKay, 2009, p153).

MacKay himself believed that he had an influence on the Government's thinking around heat suggesting that the DECC 2050 Pathways Analysis and calculator project (DECC, 2010a) had been based on his book and that had affected major DECC policy decisions (36). In an interview, David MacKay explained:

> *'the 2050 project was done partly to clarify is David Mackay's book right or what should we be doing and what does it actually look, like a sort of translation of my book into an excel spreadsheet and that 2050 calculator* [*2050 Pathways Analysis* (DECC, 2010a)] *did have, I think, quite a big direct influence on lots of policies, so Electricity Market Reform for example came straight on the heels of the 2050 calculator and Jonathan Brearley who was in charge of that policy area - he attributes the whole phenomenon of electricity market reform to things that actually came out of the calculator because before they read my book and made the calculator they hadn't really noticed the important role of electrification' (36)*

As Chief Scientific Advisor at DECC, David MacKay was involved in the heat strategy. According to the lead civil servant working on heat at the time:

> *'It would be very odd to write a strategy about heat, which is what we use half the energy in the country for, and not involve the Chief Scientific Advisor so I am guilty as charged of having involved the Chief Scientific Advisor. However, I would like to say and it's probably not easy to corroborate this statement but I would like to say that we had fruitful and frank exchanges of views on lots of issues and it certainly wasn't always his view that prevailed and in fact the electrification of heat paradigm was not a David McKay paradigm, it was a paradigm that lots of people had come to...'* (24).

While MacKay may have had some influence on the perceived importance of the electrification of heat, it is indeed true that it was an idea being put forward by many involved in heat system modelling and the development of views on

the future of heating has been considered in more detail in section 2.3. For example, the UKERC 2050 scenarios project which was the first major energy system modelling project looking out to 2050 under carbon constraints began work well before Mackay's book in 2006 and this proposed major switching from boilers to heat pumps by 2050 in order to meet carbon reduction goals (UKERC, 2009). Overall then, while David Mackay was supportive of electrification, the electrification vision cannot be attributed solely to the power of David Mackay.

The idea of a significant level of electrification of heat became an enduring and central aspect of the UK Government's strategy to decarbonise heat. Perhaps because it was so central and seen as a 'paradigm', some interviewees believed it was driven by various actors. However, with 'thorough' triangulation, the EAR approach does not highlight that any specific actors drove the heat electrification vision of Government. Rather, the evidence suggests that the key driving force for the electrification vision was the outputs from various energy system models considering the future. While the power of specific actors in this example cannot be identified, the emergence of such a strong and enduring vision could be linked to more post-structural elements of power around knowledge and discourse (the fourth face); further and much narrower research could consider this in more detail but is beyond the scope of this thesis.

8.10 POLICY EPISODE 10 - A REDUCED ROLE FOR ELECTRIFICATION? (2013)

This policy episode considers changes to the Government's long term vision for heat between their initial 2012 'strategic framework' document (DECC, 2012e) and their 2013 'meeting the challenge' (DECC, 2013i) document which saw a greater role for gas in the UK's heat system in the period up to 2050. Specifically it considers whether any actors drove this change in the Government's vision.

As described in section 2.3.3, in 2013, DECC released an updated heat framework which suggested that in the short term (up to 2050), gas may be able to play a bigger role in heating that had been suggested in the previous heat strategy which proposed a much more rapid electrification of heat (DECC, 2013k). This change was suggested by DECC to primarily have come about as

a result of new modelling which included new appliances and also considered short term peaks in heat demand in much more detail (DECC, 2013j). The new analysis showed that maintaining some gas appliances or using hybrid systems which combine a heat pump and a gas boiler could reduce system costs while also allowing carbon targets to be met.

While the updated framework represented a change, this was primarily a shorter term issue and the longer term still represented a significant transformation of the heat sector and saw a much greater role for electrification of heat.

Despite the fact that the new scenarios still relied on major growth in electric heating and heat networks, a large number of interviewees (12 in total) believed that the change represented a major shift in the UK's heat policy. Comments from interviews suggested that the gas industry believed they had some success in driving this shift away from electrification of heat. This section therefore considers whether the power of actors from the gas industry did indeed drive this increased short term role for gas.

An interviewee from a trade association which represents UK gas and electricity networks, believed that their work had influenced the position of DECC on the future of heating resulting in a greater role for gas (9). This influencing supposedly came about as a result of the publication of energy system modelling produced by consultancy Delta EE on behalf of the networks association which considered various heat decarbonisation pathways; the analysis suggested that full electrification would be more expensive than an approach which uses a greater number of hybrid heat pump systems which combine an air source heat pump with a gas boiler to provide heat at times of peak demand (9) (report here: (Delta ee, 2012)). This interviewee suggested that while there were other developments at the same time, they believed they had been successful (9):

> *'we've obviously got them to a point where they have to continue to consider the gas networks - that they have a role - so that's probably how we measure success...you know we calmed them down and took them away from their barking 'everyone's gonna have a heat pump policy' from the first document' (9).*

In a press release, regarding the updated DECC heat strategy document, the Energy Networks Association say that they '*worked closely with DECC following their announcement last year, including providing them with the most comprehensive report into domestic heat and the role of gas as part of low carbon heat solutions, which we commissioned from Delta-ee*' (Energy Networks Association, 2012) suggesting that they had been attempting to influence the position of DECC.

According to one anonymous interviewee, National Grid (a member of the ENA) and a gas and electricity network owner, engaged closely with DECC on the heat strategy. Documents show that in 2012, following the release of DECC's first heat strategy document, National Grid employed consultants Redpoint to consider technology options for heat decarbonisation which were eventually published (Redpoint Energy, 2012). This modelling, like that by the ENA suggested that hybrid heat-pumps which still use gas at times of peak heat demand (and therefore require the maintenance of the gas grid) could be a cost effective solution (Redpoint Energy, 2012). According to the consultants who carried out the modelling work:

> *'Electrification of heat and improved energy efficiency remain the critical foundation for decarbonising heat in the UK, but this study has also emphasised the potential for retaining more limited direct flows of gas to buildings to more cost-effectively manage seasonal and peak swings, whilst still meeting our environmental targets.'*
> (Baringa, 2012, (Baringa bought Redpoint))

Interestingly, the RESOM model developed on behalf of National Grid was used by DECC themselves as part of the official modelling carried out for the second heat strategy document (Redpoint, 2013). It is possible therefore that National Grid's input into the assumptions behind the development of the RESOM model could have fed through to the DECC RESOM modelling and the final 'meeting the challenge' report.

There is clear evidence of parts of the gas industry, primarily gas networks promoting an ongoing role for gas in a low carbon heat system at the time of the development of the heat strategy work by DECC and a belief by one interviewee that the gas industry had been successful. Triangulating these 'ego'

views with the views of 'alters' from the civil service does indeed suggest an element of success. One civil servant, responsible for the heat strategy work at DECC explained that in the run up to the initial 2012 document, no fresh modelling work had been done by BEIS and they had relied on existing work; the updated modelling including that carried out by the gas industry was seen as useful in highlighting the peak heat argument (24). Another civil servant in the DECC heat team explained that the switch away from complete electrification '*came about as far as I can tell as a result of the interventions of Grid and various other companies telling the CCC and DECC 'you do realise that heat really isn't that simple' via the reports*' (3).

A consultant who had been involved in the research led by the ENA agreed with the views of civil servants.

> *'I think the gas [network] companies were successful in helping to highlight the issue, I suspect, I mean DECC couldn't get all of their thinking together in one go, it's not a criticism, it's just a reality. And as DECC better understood the problem they better understood the problem of the peaks but the gas companies were quite helpful in pointing out those challenges and providing supporting evidence around that, so I don't know whether it would've happened anyway or not but they helped to support it'* (25).

Overall, the interview data suggest that the gas industry was successful in attaining their own desires (a greater role for gas in the heat strategy) and 'thorough' triangulation using the EAR instrument suggests that they have been successful in driving this change albeit it through providing what was seen as useful information. Interestingly, this example of success appears to be specifically linked to the provision of evidence to policy makers and some of the evidence, (the RESOM model) was actually used by Government themselves following its use by National Grid to support policy development. This highlights not just the 'one-off' use of evidence for lobbying but also the ongoing and enduring impact that evidence and knowledge can have in the policy process suggesting an element of knowledge institutionalisation.

In another case of the ongoing use of evidence, the model developed by Delta ee on behalf of the Energy Networks Association was also re-used but in this case by the Heating and Hot Water Industry Council (HHIC), a trade body representing the heating industry including appliance manufacturers. A representative from the HHIC explained that they had been attempting to influence DECC's position on electrification and had released their own research report. This was based on that previously commissioned by the Energy Networks Association into domestic heating pathways and also carried out by Delta ee (8). This work, much like that from the Energy Networks Association proposed a more 'balanced' approach which considered supporting lower carbon gas technologies alongside electric technologies (8) (HHIC and Delta ee, 2013). This report was however released after the second DECC heat strategy document and therefore would not have affected this policy episode.

The importance of evidence and energy system models has been highlighted in this section as particularly important for the development of the UK's heat strategy. The role of evidence and how it is used is considered in more detail in section 10.1.

Overall, this episode considers how the Government's view on heat decarbonisation changed to one which included more gas and less electricity (at least in the shorter term). Results of analysis using the EAR methodology suggest that industry, in particular the gas networks, were successful in influencing this policy change through the provision of evidence, in this case the results from energy system modelling. Interestingly, one energy system model produced on behalf of industry was actually adopted by DECC and when used by DECC produced similar outputs as it had when used by industry.

This particular policy episode highlights various elements of power. It appears that the industry had power over the Government i.e. the first face of power to cause this change. Potentially the second face of power can also be observed with the use of energy system modelling to put the issue of 'peak heat' and 'hybrid' heat pumps onto the agenda. It could even potentially be argued that the preferences of Government were shaped by these actors through the provision of evidence (third face) and finally with such a focus on evidence and the sharing of models, it could also be argued that this episode could be linked to post-structural elements of power (the fourth face). It also appears that this

episode shows organisations (across the gas industry) working together to achieve shared preferences in what has been described as 'intransitive power'.

This episode shows the potential presence of many different elements of power at one time and the connections between different elements of power and the actors involved. While this is an interesting policy episode and it does show a significant policy influencing impact, further more focused analysis on elements within this episode, particularly associated with more passive elements of power, could provide further interesting results. However, for the sake of this thesis which is focused on active power, focusing on more passive approaches to power is beyond the scope of this research.

8.11 POLICY EPISODE 11 - THE LAUNCH OF THE DOMESTIC RHI (2013-2014)

This policy episode considers changes made to the tariff levels for the domestic RHI between the time when the tariffs were first consulted on to when they were eventually introduced. It investigates whether the power of actors caused the changes to these tariffs.

In July 2013, DECC released details of the domestic RHI which was expected to be opened to applications in Spring 2014; the scheme would support biomass systems, air source heat pumps (ASHP), ground and water-source heat pumps and solar thermal with tariffs running for 7 years for each installation (DECC, 2013a).

As shown in Table 5 (overleaf), the new domestic tariff levels were different to those proposed in the original consultation document (to which they are directly comparable because both the consultation document and Government response use a 7 year tariff period). The air source heat pump tariff was reduced to below the proposed range, the biomass tariff increased above its proposed range and the solar thermal tariff increased above its range (DECC, 2013a).

	Biomass	ASHP	GSHP	Solar Thermal
Tariff range proposed at consultation stage in 2012 (payable on total heat output) (pence/kWh)	5.2-8.7	6.9-11.5	12.5-17.3	17.3
Initial tariffs for scheme released in 2013 (pence/kWh) (equivalent to tariff payable on total heat output for comparison to row above)	12.2	4.7	13.2	19.2

Table 5. Tariffs for technologies under the domestic RHI at 2012 consultation and then after the consultation at the introduction of the scheme (DECC, 2013b) *these figures represent the tariff paid on total heat output as opposed to actual tariffs to allow for fair comparison[30]*

One interviewee from a ground source heat pump (GSHP) manufacturer i.e. an 'ego' suggested that the ground source heat pump industry had played a role in these tariff changes, specifically reducing the tariff for air source heat pumps:

> *'the Micro-Power Council (*a trade association*) were very, very supportive of air source [heat pumps] and were very cross with me when we argued to DECC that this is a technology that could take off and you've got to be careful about the tariff. And we knew we were on very fertile ground here, DECC were so worried about budget that anyone saying the air source industry could explode, it could be cheap Chinese kit … DECC were going "oh we can't have this, this is a dreadful scenario" and they slashed the tariff'* (10).

It is clear from section 8.6 (policy episode 6) that there were already major concerns around the budget for the scheme and another interviewee confirmed that there were worries within DECC about the potential for a boom in heat pump deployment (14). Indeed, a civil servant in DECC explained that the trade association representing ground source heat pumps had raised concerns regarding the quality and performance of air source heat pumps and suggested that they may be over-rewarded by the RHI at the levels which had been consulted on (23) confirming the behaviour in the previous quote from a ground source heat pump representative. However, while the behaviour of the ground

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[30] Heat pumps only receive payment for the renewable heat produced i.e. the heat extracted from air, ground or water and the electricity used to pump the heat is netted off from total heat output so that only the renewable component of heat is rewarded.

source heat pump interest was confirmed, the civil servant did not confirm that this behaviour had anything to do with why the tariff was changed (23).

According to the DECC impact assessment for the domestic RHI (DECC, 2013b), the changes to the tariffs were made as a result of new evidence and research gathered through the Renewable Heat Premium Payment grant scheme and by consultants 'sweett Group' (sweett, 2013). The DECC impact assessment for the domestic RHI stated that: '*There are some significant changes which have been made to the tariffs most notably for net capital cost (Biomass is more expensive than previous evidence suggested, ASHPs are slightly cheaper)...*' (DECC, 2013b). The tariffs were, according to DECC, adjusted to take account of these new capital costs, with higher tariffs for biomass reflecting higher perceived biomass boiler costs and lower tariffs for ASHPs reflecting perceived lower ASHP costs. While the grey data shows that the tariffs were changed, triangulation using the EAR methodology does not attribute this change to the ground source heat pump industry.

The eventual reduction in the air source heat pump tariff was seen as a success by some (10,11), particularly those involved with ground source heat pumps who claimed a small victory (10) (although the evidence doesn't suggest they caused this change). However, the level of success for the GSHP industry was limited because the domestic GSHP tariff was set near the bottom of the proposed spread of tariff levels and it was also the case that the biomass tariff was significantly higher than had been expected by industry. One interviewee explained '*It was a policy success, but hurting them and not helping yourselves [GSHP] was a fairly disappointing outcome*' (10).

Interestingly with regard to biomass which also saw an increased tariff, when asked whether there had been any lobbying from the biomass industry to increase the biomass tariffs, one civil servant suggested that they had no reason to lobby because:

> *'they have been treated very generously by DECC with absurdly large subsidies for biomass boilers which have been flooding in to dubious locations all around the country for many years now so I didn't see much lobbying from them because yeah they were just getting fat on the subsidies and didn't need to lobby me' (36).*

It is important to note that the report from 'sweett group' on which the new tariffs were based used questionnaires completed by industry participants such as installers to gather cost data (sweett, 2013). This reliance on industry data is an example of the potential power that industry actors can have when policymakers source information, on which policy is based, from interested actors. Information needed for the development of policy can be provided by industry which is broadly in alignment with the interests of the relevant company in order to promote large subsidies or supportive regulation. Elsewhere this has been referred to as 'informational asymmetry' (Helm, 2006, p180). In this example, the details of who responded to the questionnaire are not available. The general issue of the role of data or knowledge from industry in the development of UK heat policy has been seen as an important element of approaches of actors to influence and will be discussed in more detail in section 10.1.

Overall then, in this episode, while the tariffs were clearly changed between the consultation document and the introduction of the scheme, 'part' triangulation using the EAR instrument does not show that industry lobbying caused this change even though one part of industry thought it had had power. While lobbying success cannot be identified, the attempts by the Ground Source Heat Pump lobbyist could be seen to be linked to the third face of power. By playing on existing and known concerns around budgets, the lobbyist for the GSHP industry was attempting to shape the preferences of the civil servants to frame heat pumps as a poor technology and one that could grow rapidly in order to get tariffs reduced for a potentially competing technology.

8.12 POLICY EPISODE 12 – MORE CASH FOR BIOMASS (2013-2014)

This policy episode considers the changes made to RHI budgets which resulted in a significant increase in the budget available for small and medium biomass installations under the non-domestic RHI. This change meant that the tariffs available for these technologies remained higher than they otherwise would have done. It considers whether actors had any power in driving this change to budgets.

Before the domestic RHI scheme was opened to applicants in April 2014, DECC released its 'Improving Support, Increasing Uptake' document focusing

on the non-domestic scheme (DECC, 2013e). As well as proposing the introduction of new technologies, the document also explained that the Government's existing budget management system (degression) for the RHI would be changed in a number of ways. The most significant change was that the trigger levels which determine what level of deployment causes a tariff reduction were to be modified.

Two technology groups were deploying over what was expected (small and medium biomass at 173% and 151% of expected spend respectively) and other technologies were delivering well below what was expected. This included:

- Large biomass spending only 27% of what was forecast;
- Small ground source heat pumps 1% of what was forecast;
- Large ground source heat pumps 7% of what was forecast;
- Solar thermal 1% of what was forecast;
- Biomethane 8% of what was forecast.

(DECC, 2013e)

DECC was concerned that the high delivery of small and medium biomass would lead to their tariffs being automatically reduced by the degression mechanism; this would then lead to reduced deployment of the technologies that were being successful from a deployment perspective. With other technologies deploying well below expected levels, and technologies deploying successfully expecting to see tariffs reduced, money allocated to the RHI would go unspent and renewable heat deployment would be reduced.

For underperforming technologies, tariff reduction trigger levels were to be reduced and small and medium biomass had their trigger levels increased. This meant that budget that was not spent and looked unlikely to be spent on the underperforming technologies was moved onto small and medium biomass approximately doubling their budgets and in doing so reducing the likelihood of a tariff degression for these technologies (DECC, 2013e).

Two interviewees from the Renewable Energy Association ('egos' under the EAR methodology), a trade association interested in biomass, suggested that their lobbying efforts had caused this change, increasing the budgets available for small and medium biomass (11, 14) with one of them explaining '*no-one else was asking for that*' (11). It was even suggested that this particular policy

change represented a fairly easy win as there are only a small number of officials involved in managing the budget element of the RHI (subject to eventual ministerial sign off) and so the policy change was easy to influence (11). The REA had a clear interest in biomass, founding the Wood Heat Association (Wood Heat Association, 2018) and they also attribute this tariff increase to their own advocacy efforts explaining that they '*secured budget increases of +40% for sub 1MW biomass in December 2013*' (Wood Heat Association, 2018).

Triangulating the views of interviewees from the REA with those of civil servants (alters) provides a complex picture. It is clear that DECC were engaging closely with industry on delivery of technology under the RHI employing a so-called 'Head of Market Intelligence' to understand the sector better and support further policy development/adjustment including changes to the budgets (23). Another civil servant explained: '*there was quite a big feed-back loop with industry. Now they might not quite necessarily know how big partly because dependent on how...what you wanted to use people's information for, you might not want to make it completely obvious because you don't want to put an easy lobbying gaming opportunity in people's paths. But I think it was probably more collaborative than a lot of people think it was*' (27)

However, the same civil servant did not attribute the increase in the budgets for the RHI to lobbying by the RHI explaining

> '*as I remember this one I think to be honest it was a bit of a no brainer because at the time that we were making those changes frankly it would've been inconceivable to not increase the amount of money that was being given to biomass because otherwise we would have been as I said earlier, deciding that we weren't going to be spending the money at all, because the timeframes that we were talking about meant it would've been inconceivable to have other technology markets rise to the level of expenditure that they would need to soak up the rest of the budget*' (27).

Overall then, the role of the REA in this change is not confirmed by the relevant policy makers and may simply have happened without their input. Exploring the associated grey literature suggests that engagement by DECC with the REA on

these issues did indeed take place. The Government impact assessment behind the proposals explains that they gathered data using: '*Industry reports; Trade Association data; pipeline data; trend extrapolation; stakeholder interview and internal expert judgement*' to build '*market intelligence*' and they specifically mention the REA in the impact assessment as someone who Government engaged with (DECC, 2013j, p19). So, while 'thorough' triangulation of sources doesn't indicate a clear impact, it is clear from both interviews and grey literature that the REA were involved in the process and the policy episode represents a clear success for the industry they represent.

However, while this may be a success, this change can't be attributed to the power of the REA and this once again shows the limits of 'preference attainment' methods for considering political power. When considering this episode from the faces of power approach, while the REA seemed to be attempting to have the first face of power over the government, they do not seem to have been successful. However, it is possible that the fourth face of power is important here with Government looking for knowledge and data on technology costs and deployment to support their policy design and this potentially power laden knowledge being provided by industry. Once again this episode highlights the importance and power of knowledge when considering policy change highlighting understandings of power linked to the fourth face.

The changes to the tariffs and scheme budget came into force on the 28th May 2014 (Ofgem, 2014).

8.13 POLICY EPISODE 13 - BIOMETHANE TARIFF REVIEW AND SUSTAINABILITY (2014-2015)

This policy episode considers the potential power behind two policy modifications to the non-domestic RHI which affected biomethane. The first relates to a new biomethane tariff design and the second relates to the introduction of 'sustainability criteria' which biomethane (and other bio-energy under the RHI) has to meet to receive payment under the RHI. With both policy changes happening at a similar time this episode considers the potential power of the biomethane industry and its impact on these changes.

In May 2014 DECC published a consultation into the RHI tariff for biomethane producers amid concerns that large plants were making larger financial returns than planned through the RHI (DECC, 2014b). The consultation presented two potential options, one was to introduce a 'banded' tariff which paid different RHI rates depending on maximum capacity of the biomethane production plant. The second option was to introduce a tiered tariff similar to the style of tariff which already existed for small and medium biomass installations in the non-domestic RHI; on an annual basis, an initial amount of annual biomethane production would be paid a certain tariff and any biomethane produced beyond the tier threshold would receive a lower rate (DECC, 2014b). The idea of both options was to reduce levels of financial return for the largest projects and even out levels of return across scales of projects. The proposed banding and tiering options are shown below in Figure 8-2 and Figure 8-3 respectively.

Band	Capacity range (MW)	Scenario 1 at £41/t gate fee Suggested tariff (p/kWh)	Scenario 2 at £25/t gate fee Suggested tariff (p/kWh)
Band 1	>0-3	7.1	9.9
Band 2	>3-6	2.7	5.4
Band 3	>6-9	1.2	3.9
Band 4	>9	0.5	3.1

Figure 8-2. Proposed option (2[31]) for banded biomethane tariff (DECC, 2014b, p41)

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[31] One other similar but more complex banded tariff, with similar tariff levels was proposed as a potential option but this one is provided as an illustrative example

	Scenario 1 at £41/t gate fee		Scenario 2 at £25/t gate fee	
	Tier 1	Tier 2	Tier 1	Tier 2
Biomethane Injected (per year)[a]	Up to 15,000 MWh	Above 15,000 MWh	Up to 15,000 MWh	Above 15,000 MWh
Tariff p/kWh on Biomethane Injected	7.1	0.0	9.9	2.1

[a] 15,000MWh per year is the approximate output of a 2MW biogas capacity plant

Figure 8-3. Proposed option for tiered biomethane tariff (DECC, 2014b, p45)

Following the consultation, DECC announced that they would introduce a tiered tariff as opposed to a banding approach but that the tiered tariff would have three levels. However, the proposed tiered tariff had higher tariff levels than any of the proposals in the consultation (DECC, 2014c). The proposed tariffs are shown in Figure 8-4 but are not directly comparable to those in Figure 8-3 because the split of tiers has changed between consultation and response. This increase in tariffs from consultation was, according to DECC, because responses had suggested that DECC's assumptions regarding feedstocks contained too high a proportion of food waste and this food waste had been assigned too high a value (referred to as 'gate fees') (DECC, 2014c). The new tiered tariff was introduced in January 2015 at the higher tariff rates[32] (Ofgem, 2018c). After this date, the expenditure on biomethane has been above (in some cases double) expected levels (DECC, 2016a) suggesting that the new tariff had little effect on reducing the growth of biomethane and this appears as a positive policy change for industry[33].

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[32] These are actually higher than the rates in the Government response as they had been increased to take account of inflation

[33] In light of deployment beyond expected levels, the biomethane tariff has since been automatically reduced by degression and the delivery of new biomethane plant had slowed significantly (BEIS, 2018h). However recent data suggests that this year there have been a higher number of applications as a result of more recent changes to tariffs which came into effect this year after consultation in 2016 (BEIS, 2016; Ofgem, 2018c).

	Tariff p/kWh[1] (FY 2014/15)	Tier Break (Output at which tariff changes) – MWh per annum of eligible biomethane injected	Approximate biogas plant capacity that produces an annual output equivalent to tier break - MW
Tier 1	**7.5**	40,000	6
Tier 2	**4.4**	80,000	12
Tier 3	**3.4**	> 80,000	> 12

Figure 8-4. Proposed tiered tariff levels for biomethane following DECC review (DECC, 2014c, p6)

The second policy change links to rules around the sustainability attributes of biomethane. After being delayed, these rules came into force on the 5th October 2015 (DECC, 2015b). The rules consist of 2 elements:

1. All bio-energy rewarded by the RHI must meet a certain level of lifecycle emissions for each unit of energy produced and this is set at 34.8 gCO2e/MJ of heat (equivalent to 60% GHG savings against the EU fossil fuel average at the time it was introduced) (Adams *et al.*, 2015)
2. The land on which any bio-energy is grown which will claim the RHI, for example energy crops to produce biomethane, must meet certain criteria. Crops must not be grown on land which was primary forest, peat land or designated for nature conservation activities (Ofgem, 2018b)

One specific change was made to the rules for sustainability for biomethane which meant that the required level of carbon saving was actually less than it had been originally expected to be. Originally, DECC explained that the greenhouse gas limit for the RHI would be '*34.8g CO2 equivalent per MJ of heat generated*' (DECC, 2013d, p83) like for other bioenergy technologies. The inclusion of the term '*heat generated*' would mean than a conversion factor to consider the efficiency of the final combustion in a gas boiler would need to be included in the calculation of life cycle emissions.

The regulations for biomass and biomethane sustainability came into force on February 5th 2015 (DECC, 2015a) and the actual requirement to meet the rules

came into force on 5th October 2015 (Ofgem, 2015). However, for biomethane, the boiler conversion factor was not included in the final regulations. As shown in Figure 8-5, under section 2(c) in the regulations, the conversion factor 'η_h' is not included as it is for other technologies under sections 2(b) and 2(c). As explained by DECC in publication of biomass and biomethane sustainability, '*When biomass sustainability becomes a requirement of the RHI we will not initially require biomethane producers to take end-use efficiency into account when calculating their life-cycle GHG savings, i.e. they will need to produce life-cycle GHG emissions of 34.8gCO2e/MJ or less at the point of injection*' (DECC, 2015b).

"SCHEDULE 2A   Regulation 36A

Greenhouse gas criteria

1. Solid biomass, biogas or biomethane meets the greenhouse gas criteria if the lifecycle greenhouse gas emissions associated with each consignment of that solid biomass, biogas or biomethane are less than or equal to 34.8g of $CO_{2\,eq}$ per MJ of heat generated (in the case of solid biomass or biogas) or biomethane injected.

2. Lifecycle greenhouse gas emissions shall be calculated as follows—

   (a) where heat and power is generated from solid biomass or biogas, the following formula shall be used—

$$\frac{E}{\eta_h}\left(\frac{C_h \times \eta_h}{\eta_{el} + C_h \times \eta_h}\right)$$

   (b) where heat is generated from solid biomass or biogas, the following formula shall be used—

$$\frac{E}{\eta_h}$$

   (c) where biomethane is produced from biogas, lifecycle greenhouse gas emissions shall be E.

3. For the purposes of paragraph 2—

   (a) η_h is the efficiency of the plant in which the heat is generated, calculated as $\dfrac{H}{F}$

      where—

      (i) H is the heat produced by the plant in the form of liquid or steam from all fuels used in that plant, and

      (ii) F is the energy content of all those fuels;

Figure 8-5. Extract from 2015 RHI regulations showing that for biogas and solid biomass (b) a conversion factor (η_h) is used but for biomethane (c) it is not included (Parliament, 2015)

This change effectively reduced the required level of carbon reduction for biomethane under the sustainability rules by around 10% because the energy losses in gas boilers no longer needed to be considered in the GHG calculation (based on 90% boiler efficiency) (11). In practice, this means that producers of biomethane would be able to use higher carbon feedstocks or have operations with higher levels of gas leakage than would otherwise have been the case. In making the greenhouse gas saving criteria easier to meet, this relaxation of the rules from what was previously expected represented a further success for the biomethane industry on top of the previously mentioned tariff changes (11, 13, 14).

With regards to the first element of policy change in this episode, the tariff changes, three interviewees from trade associations which represent biomethane interests (egos under the EAR methodology) suggested that this tariff change represented a policy influencing success for themselves and the biomethane industry and that it came about partly as a result of their lobbying activities (11, 13, 14). With regards to the change to the sustainability rules, none of the interviewees claimed success but two interviewees suggested they were engaging with DECC on the issue (11, 14).

Using triangulation to consider these policy changes, specifically regarding both of these biomethane issues a civil servant working on the RHI at the time explained:

> Interviewee: '…Biomethane is probably a good example where you've got some wealthy landowners who are well connected with people in the House of Lords and into the politicians and they can smooth the waters or at least make the right phone calls or send the right notes and say, my constituent is concerned about this issues, can you sort it out. There was quite a lot of that in that area.
>
> RL: And was that when the RHI was first being introduced or is it since then?
>
> Interviewee: It was around all of the changes that we were thinking about for biomethane, there was a lot of that background activity going on.

RL: Was that tariff changes to biomethane?

Interviewee: Yeah and the sustainability stuff as well. There was clearly some back-room stuff going on, it felt like that at times. You would get messages coming down from ministerial offices and thinking where did that come from? And those people obviously knew how to go about doing that, sending the right messages.

RL: And was that the actual land owners or trade associations working with them?

Interviewee: I think in some cases it was the land owners involved, the people who owned the project…I think it did actually help on the tariff setting, we did let them off fairly lightly in the end on the tariffs. It could've been a lot worse. And the sustainability stuff we did delay it for a long time, we did rethink on some of the numbers quite a bit as a reaction to some of that lobbying.'

So in this episode, triangulation with an alter suggested that while the biomethane industry may have seen policy successes with regards to sustainability criteria and tariffs, this may not be as a result of the trade association lobbying but instead a result of the political influence of '*wealthy land-owners*' who were investing in biomethane (23).

A web search considering grey literature associated with this change has only provided limited data. However, a quote from the National Farmers Union (NFU), a trade association representing the farming industry and agricultural landowners, boasts on its website that the maintenance of a higher biomethane tariff agreed by the energy minister until December 2014, was a '*policy-influencing 'win*" (NFU, 2014). This suggests that the NFU had been lobbying around this biomethane tariff issue and believed they had been successful in causing DECC to maintain higher biomethane tariffs at least in the short term.

From a theoretical power perspective, this policy episode highlights the potential importance of personal relationships and how these can be related to the first face of power. The civil servant is implying that 'wealthy landowners' had power over DECC with regards to biomethane and that land owners had an element of agent based power. It should also be noted that the civil servant suggests that

these wealthy land owners have links to the House of Lords and members of the House of Lords may be part of or linked to the Government at the time providing a possible route for communication between landowners and ministers. From a methodological perspective, this episode highlights once again how evidence of lobbying may not just emerge from 'egos' but also from 'alters' and the EAR instrument could therefore be strengthened by explicitly taking this into account. While providing 'part' triangulation, this episode also highlights the difficulty in obtaining evidence to fully triangulate evidence from interviews. It is the potential communications between ministers and 'wealthy landowners' that would strengthen the findings of this policy episode but searches have revealed no evidence of these.

As a result of the two aspects of this policy episode, biomethane projects are allowed 10% higher greenhouse gas emissions than they otherwise would have and tariffs were set to be more generous than they otherwise would have been.

While the focus of this thesis is on the power of actors to cause policy change, the policy changes which are the subject of this policy episode appear to have had real world impacts. Before the 2014 tariff review, biomethane was responsible for 5.8% of the cumulative heat delivered by the non-domestic RHI, however, by July 2017, biomethane formed 20% of the heat delivered by the scheme and no changes apart from the tariff change seem able to have driven this. This indicates that in light of the tariff review, part of which was to control the growth of biomethane, the delivery of biomethane actually increased as a proportion of the scheme (Based on BEIS, (2017b) statistics) and deployed beyond pre-determined budget limits (DECC, 2016b). This is particularly interesting considering that the Government's 2011 impact assessment expected biomethane and on-site biogas combustion combined to be responsible for just 7% of the scheme's overall output. It is also likely that the carbon savings associated with biomethane in the non-domestic RHI have been reduced due to the change in the sustainability criteria causing further real world impacts.

8.14 CHAPTER CONCLUSIONS

This chapter has presented a number of UK heat generation policy 'episodes' between 2003 and 2015 where the power of actors to cause policy change has

been investigated. These episodes primarily but not solely emerged from interview data and were developed using the triangulation approach of the EAR instrument. The period outlined in this chapter represents an important time in UK energy policy associated with heat decarbonisation with the introduction of large scale financial support for renewable heat and the development of a long-term vision for the UK heating system under carbon constraints.

Key episodes where actors have had or attempted to have power over the policy process include the role of individuals and the Renewable Energy Association in the creation of the RHI legislation, the political power of the secretary of state to push the RHI into existence, the role of evidence to shape the heat strategy and the tariffs for renewable heat support and the role of high-level political support for the biomethane. Throughout the chapter, how the policy episodes relate to the key theoretical understandings of power introduced previously, have been discussed. Table 6 below summarises the key elements of power identified within each episode as well as the depth of triangulation which was possible. Where the fourth face of power has been potentially identified, the 4 is followed by a question mark to highlight the difficulty and uncertainty of this element of power. 'N/A' indicates that power or an element of power has not been clearly identified in the episode.

Policy episode	Face of power identified	Structural or agent based power	'Power over' or 'power to'	Depth of triangulation (none, part or thorough)
1 - The introduction of legislation mandating condensing boilers (2003-2005)	1, 2	Structural, associated with ministerial authority and existing policy momentum	'Power over' associated with ministerial authority	Part
2 - The creation of the Renewable Heat Incentive in law (2008)	1, 2, 3	Structural, associated with the power of MPs and also agent based, associated with organisations lobbying politicians	'Power over' associated with authority of MPs and 'power to' associated with groups working together to influence Parliament	Thorough
3 - RHI scheme design (2009-2010)	N/A	N/A	N/A	Thorough
4 – How to fund the RHI (2009-2010)	N/A	N/A	N/A	Thorough

5 - The brief overlooking of the RHI (2010)	N/A	N/A	N/A	None
6 - The mandarin and the near death of the RHI (2010-2011)	1	Structural, associated with the authority of a senior civil servant	'Power over', the civil servant had power over the policy change	Part
7 - RHI scheme implementation (2011)	1	Structural power of Government highlighted in ability to make significant policy change regarding tariff 'cost effectiveness'	'Power over' associated with Government ability to modify regulations without opposition	None (but clear evidence of policy change in grey literature)
8 - The increasing importance of heat in Government and the emergence of a heat strategy (2011-2012)	N/A	N/A	N/A	Part
9 - The electrification vision (2012)	4?	N/A	N/A	Thorough
10 - A reduced role for electrification? (2013)	1,2,3,4?	Primarily agent based	'Power to' with evidence of industry working together (intransitive power)	Thorough
11 - The launch of the domestic RHI (2013-2014)	N/A	N/A	N/A	Part
12 – More cash for biomass (2013-2014)	4?	N/A	N/A	Thorough
13 - Biomethane tariff review and sustainability (2014-2015)	1	Agent based in the sense that individuals caused the changed to happen but structural in that this was built on existing relationships	Primarily 'power to' as this was driven by the industry and not institutional power	Part

Table 6. Summary of elements of power identified within policy episodes and depth of triangulation

This chapter has also highlighted the difficulties with measuring and explaining the role of power in policy change. Issues include being able to corroborate the comments of interviewees, competing views, obtaining valuable evidence and the scale of investigation.

Importantly for policy, a number of the policy changes identified in this chapter have provided greater levels of support for bio-energy technologies and it is bio-energy which has dominated the RHI scheme so far (see section 2.4.2.3). As actors have been identified as being successful in affecting some of these changes and these changes seem to have affected deployment of renewable

heat, it seems very likely that industrial actors have had the power to affect renewable heat deployment in the United Kingdom. This chapter has therefore highlighted the power that actors associated with socio-technical systems can have on policies associated with transitions of those systems. It has shown that the power of those actors can have real world implications and therefore potentially serious implications for transitions.

9 UK CASE STUDY - ACTORS IN THE UK HEAT POLICY NETWORK – RESULTS AND DISCUSSION SECTION 2

The previous chapter considered the key policy episodes associated with UK heat policy between 2003 and 2015 and the role that power is understood to have played in these episodes. Building on the previous chapter, this chapter presents the results of analysis which has focused on the UK heat policy network, considering the actors and interests who have been involved in heat generation policy and their associated actions.

As described in the methodology section (7.4.1), interview data was coded and codes generally fitted into three main themes, 'what', 'who' and 'how'. The basis of this chapter is the 'who' aspect of the coding which considers the actors who have emerged as being involved in the development of UK heat policy development. Links between this, and the other results chapters are indicated where relevant. Because the actors emerged from the coding process, actors of various sizes are considered, ranging from single individuals up to entire Governments.

To some extent, the methodological approach employed in the previous chapter was also used to consider the role of different actors. This meant that where possible, data was triangulated between sources (although triangulation between egos (lobbyists) and alters (policy makers) was not always possible) in order to investigate where specific actors had attempted to influence policy. Where actors have been identified attempting to influence the policy process, ideas from the faces of power model are introduced in order to understand how the approaches of various actors link to theoretical perspectives on power. The following sub-sections consider the key actor groups highlighted by the interview data and more specific actors are discussed in sub-sub-sections. The sections are presented in no particular order.

9.1.1 Government power

A key group of actors which emerged from the coding is 'Government' and within this code, comments from interviewees referred to the ability of Government (and Government associated actors, such as civil servants, ministers and associated bodies) to have power over policy change. Overall this group had the highest number of references after the coding. This section briefly considers some of the lesser referenced actors within the group, namely the Committee on Climate Change and the Treasury; actors with higher numbers of references are discussed in more detail below under their own headings.

Two interviewees specifically mentioned the influence of the statutory Committee on Climate Change (CCC) for raising the profile of heat (5) and also for the production of evidence such as reports which have then used been used for wider lobbying work by NGOs (39). The position of the Committee on Climate Change as a statutory body which can produce recommendations that the Government must legally respond to (Parliament, 2008a) suggests they have an element of power over the Government and this is linked to their legal standing so this could be seen as a more structural form of power. However, while the role of the CCC was mentioned briefly in policy episode 9 (the electrification vision) in the previous chapter, the actual power of the CCC on heat policy did not emerge as a driver for any policy change identified in any of the policy episodes.

A number of interviewees recognised the role of HM Treasury in the development of UK heat policy and most of these comments concerned the RHI. The Treasury was mentioned specifically in policy episode 5 concerning the funding of the RHI which was eventually allocated through the 2010 spending review led by the Treasury (HM Treasury, 2010b). This policy episode suggests that the Treasury, which controls Government spending did have some power over the RHI, as without funding from Treasury, it wouldn't have existed. Two civil servants suggested that they were actually very pleased that there was any funding for the RHI; this was after all at a time when Government was looking to reduce regulation and spending (24, 26) and so from this perspective, the Treasury and its behaviour was seen favourably.

One interviewee suggested that the Treasury had forced a reduction in the maximum rate for tariffs under the RHI to a rate equivalent to the support offered to offshore wind with the aim of ensuring value for money (10). This particular link to offshore wind costs is mentioned in the Government's 2011 RHI consultation response document which explains that the reason support for solar thermal technology in the non-domestic sector was initially set at 8.5p/kWh (lower than had previously been consulted on) was because the Government did not want to fund anything which was more expensive than offshore wind; offshore wind support at the time equated to 8.5p/kWh. However, the spending review document does not mention this cost cap (HM Treasury, 2010b) and so it is not possible to ascertain that the Treasury did have power over this policy change; other grey literature providing further insight into this issue has not been located.

Policy episode 8, which considered the development of the DECC heat strategy work also involved the Treasury although it was not apparent in this episode that the Treasury did have any power over that element of policy.

Whilst comments regarding the Treasury weren't necessarily negative, they do indicate the power of the finance ministry over energy policy making with departmental spending decisions being fundamentally controlled the Treasury. This indicates that the Treasury had power over elements of DECC's decisions around the RHI and was able to exhibit the first face of power in controlling the overall RHI budget which it can do as a result of its institutional situation. The power of the Treasury could therefore be seen as a more structural form of power.

The following two sub-sections consider two types of Government actors which emerged as particularly important from the coding of actors.

9.1.1.1 Civil Servants

Unsurprisingly, many general comments referring to the power within the development of heat policy recognised the important role of civil servants in shaping policy outcomes (19, 11, 16, 19, 23, 31, 32, 38). In the policy process, civil servants are central to the development of policies and all policy decisions will at some point involve civil servants (although it will be ministers who make most final decisions). Interestingly, some interviewees believed that the

personal situations of civil servants would affect their beliefs and objectivity in decision making (19) as would their own efforts to protect their jobs (10). The implication is therefore that civil servants may not necessarily make fully objective decisions.

More institutional issues which were suggested included the fact that many civil servants were economists rather than engineers and some believed this had negatively affected policy as decisions were being made without a good understanding of technologies (10, 32) (recent civil service data does not provide data on the background of civil servants and so this claim cannot be validated (ONS, 2018)). Others commented on high rates of staff turnover explaining that because civil servants frequently changed roles there were issues with continuity (11, 31). Some interviewees also suggested that internal conflicts and the separation between DECC departments had affected policy outcomes, for example some civil servants focused on renewables targets and others focused on reducing carbon emissions and as a result, there have been conflicting policy goals (16, 17, 19). One policy issue linked to this idea of policy conflicts was the design of the RHI which initially targeted deployment of renewable energy rather than reducing greenhouse gas emissions; this was discussed previously in policy episode 6. It should be noted that more recently, the Government has modified support under the RHI to support technologies with a longer term and low carbon strategic importance (BEIS, 2016).

A number of interviewees believed that the 'submission' process for making policy decisions in DECC empowered civil servants (10, 28, 32). This process is the main method by which ministers decide on the course of policy and involves the production of papers on particular issues which are placed within the relevant minister's red briefcase at the end of the day to take home (Civil Service Learning, 2015). Within these submissions, civil servants will outline a policy issue on which a decision needs to be made by a minister and propose a number of options, normally including a preferred option (28). One interviewee believed this allowed civil servants to make their preferred outcome more likely (10):

> *'the submissions they send to ministers are written in a very*
> *compelling fashion if they want a particular outcome. They are*
> *very talented at slanting the submission towards that outcome,*

> *'would the minister agree that...?' And you get four or five things*
> *that look really appealing and you don't necessarily get the*
> *alternatives' (10)*

Unfortunately, while this submission process may be seen as empowering for civil servants, submissions are not publicly available and so grey literature is not available to consider this issue in more detail.

Because of the perceived importance of civil servants, some interviewees recognised the importance of building relationships to ensure that civil servants support policy ideas as well as ministers (23, 26).

> *'…basically you need to have the officials on side already. The*
> *officials need to think that actually this idea, from these people is*
> *quite a good one and you need to try and convince the minister*
> *let's do it together. So we'll [civil servants] come with you and*
> *persuade the minister it's a good idea but your chances of going in*
> *completely cold to a minister and persuading them some new*
> *thing are slim I think unless you do get very lucky' (23)*

Another interviewee supported this idea and explained that they had found the use of employing a lobbyist very limited and '*because of the attitudes in DECC it ultimately wouldn't have mattered if we'd employed Saatchi and Saatchi* (a major communications agency), *it wouldn't have made much difference*' (38).

The previous paragraphs indicate general thoughts on the power of civil servants to drive policy and show that interviewees perceive civil servants as powerful. However, the previous chapter highlighted that the only time a civil servant clearly had power (according to triangulation of the data collected in this research) was in policy episode 6 where DECC's permanent secretary slowed down the introduction of the domestic RHI. That is not to say civil servants have not had power elsewhere and they are clearly involved in all policy decisions however, this is the only time when this research has showed the clear power of civil servants. It should also be noted that the potential power of civil servants is closely linked to their position in Government where they have the ability to do things that others cannot, such as draft legislation and policy and work closely with ministers. The power of civil servants is then clearly linked to their institutional situation and could be seen as a more structural element of power.

9.1.1.2 Ministers

Interviews also highlighted that ministers were seen as powerful actors associated with the development of heat policy. UK government departments are led by a combination of a permanent secretary from the civil service side and ministers from a political side; a secretary of state is the minister with overall responsibility for the department. Within the departmental relationship, the political side is responsible for setting the direction of a department, representing the department in Parliament and publicly and making policy decisions (Civil Service Learning, 2015).

The submission process which forms the basis for policy decision making has been discussed in section 9.1.1.1. While civil servants appear to have some power over policy decisions, interviewees specifically recognised the political power of ministers (14, 19, 32):

> *'civil servants prepare and in the end it is always the minister that decides' (14)*

> *'that [the evidence base] can be circumvented by ministerial diktat, a minister can have their own personal likes and dislikes and drive the debate however they want' (19)*

Examples from the policy episodes of ministerial support for policies include Margaret Beckett pushing for the introduction of condensing boilers when she was in power (8, 20)(policy episode 1) and Chris Huhne, when secretary of state for DECC supporting the introduction of the RHI (policy episode 26, 29) (policy episode 5); Greg Barker (as a minister for DECC) was also recognised as being generally supportive of the RHI policy (28). Triangulation in the previous chapter showed that it was only Margaret Beckett during policy episode one who had power to cause the policy change and actually policy episode 6 highlights how the power of ministers can be constrained, in this case by the civil servants (limiting the scope of the RHI).

In another example of the limits of ministerial power, according to one interviewee, Greg Barker was personally very supportive of introducing a specific heat subsidy for combined heat and power systems; however, in light of concerns among civil servants and thorough analysis, no such direct support was introduced (36). As this was an internal DECC issue, no grey literature is

available to confirm this. It was also suggested that it was well known in DECC that Greg Barker was closely connected to the REA (Renewable Energy Association trade association) and so civil servants ensured that they took views from across stakeholders and scientific evidence on relevant issues rather than purely following Greg Barker (26, this has not been confirmed by grey literature); this again highlights the potential ability of civil servants to limit of ministerial power.

Understanding the power of a minister to make policy change is not a simple matter and there has been no significant research into the power of ministers for over four decades (Norton, 2000). Norton's (2000) analysis (a small scale review) recognised the impact of civil servants on ministerial power and suggested that ministers generally saw their relationships with civil servants as '*positive*' (p112). While this previous analysis explained that ministers have the power and legal authority to make decisions other people cannot, it suggested the biggest limit to the power of ministers was the prime minister or the chancellor or other external influences such as the EU. This again highlights the limits of the power of ministers and policy episode 5 describes a specific time when the Treasury had power over the minister, in this case deciding whether or not to allow funding for the RHI.

There is no doubt that Government ministers have some level of power in driving policy, both in their ability to control the direction of departments and in their role as final decisions makers on policies, and these aspects have been shown within this research. However, the power of ministers is bounded by their institutional setting and is limited by both what the wider Government (including the Treasury) is doing and also bounded by the structures of the Government which places a significant level of power on civil servants to control or in some cases limit the wants of ministers.

From this research I have shown that ministers can exhibit characteristics of the first face of power having power over policy decisions and that they can also exhibit characteristics of the second face of power in their ability to set departmental policy agendas. However, this research has also highlighted the limits of the power of ministers, suggesting that ministerial power alone may often not be enough to drive policy change and the power of ministers, as with other actors must be considered in its institutional context. The power of

ministers like that of civil servants can also be seen as associated with more structural ideas of power linked to their privileged position.

9.1.2 The incumbent heat actors

The idea of 'incumbency' was introduced to this thesis in chapter 2 which considered the development of UK heat pathways. The idea was also discussed in section 3.3 which considered the power of incumbents to affect transitions. The interests of and engagement by incumbents around heat policy was visible in two policy episodes including episode 1 (gas boiler manufacturers and the introduction of condensing boilers) and policy episode 10 (the gas industry, the heat strategy and the future role for gas). This section considers the specific interview data associated with incumbents and their power in the heat policy process. The following sub-sections focus on specific incumbents or groups of incumbents.

A number of interviewees suggested that the RHI was currently too small a policy to concern the large incumbent companies (11, 13, 23, 34). This could explain why there appears to be limited engagement by incumbents around the RHI, but some engagement on more strategic issues (the gas industry on the heat strategy) and those with a more direct impact (boiler manufacturers on condensing boilers).

There was a belief among some interviewees that the size of actors could affect their impact on policy. It was suggested that because of their scale, compared to non-incumbents, incumbent companies which are already operating at size in the heat system had their own 'momentum' which keeps the system going (anonymous), and that these larger companies have the resources and ability to engage in the policy debates which smaller companies do not have (anonymous, anonymous, 20). Another interviewee recognised the presence of these large heat companies at many heat policy events and conferences (5). Overall, findings suggest that larger companies, purely as a result of their scale, may have the capacity to engage with policy in a way which smaller companies can't, giving larger companies the capacity to have more power in the policy process. This is a similar conclusion to the recent UKERC project investigating incumbency in the UK heat sector which showed that the scale of policy

engagement by incumbents was far greater than that by new-entrants and therefore the voices of new entrants were often not heard (Lowes *et al.*, 2018b).

One interviewee suggested that because of the lack of proper scrutiny of evidence by DECC due to issues with departmental capacity, DECC effectively perpetuated the messages of these incumbent companies by often believing advice and evidence which they provide at face value (40). The issues of power and knowledge is specifically considered in more detail in section 10.1 in the next chapter.

Overall, despite their scale, the impact on heat policy of the UK's largest energy suppliers, the so-called Big 6, appears limited. They were seen to be generally supportive of the introduction of the RHI (10, 11), but opposed to the RHI being levied on fossil fuels (11, 26, policy episode 4). While some interviewees believed that the Big 6 companies had large teams of policy and government relations staff and a capacity for detailed work on heat, interviewees couldn't attribute any specific heat policy changes to the Big 6 players (16, 19). A possible reason for this is simply due to the limited interest of the Big 6 in this area (23), suggesting that the Big 6 did not see heat policy as a major threat/or interest to their businesses.

The following sub-sections consider specific incumbents or groups of incumbents which were highlighted during interviews. They are shown in no particular order and some sections have been anonymised for ethical and legal reasons outlined in section 7.6.

9.1.2.1 Company 'A' (identity protected)

'A', a company which distributes fossil fuel to houses and buildings off the gas grid appeared in a number of both civil servant and industry interviewee comments (11, 15, 26, 29, 39). Company 'A' also appeared in policy episode 4. Interviewees believed 'A' had been a very vocal member of the heat policy network but suggested the impact of their engagement may have been limited. One civil servant asked, '*who pays any attention to 'A*'?' (anonymous) and this may be linked to the fact that 'A' only represent a small part of the market (24). Nonetheless, despite being small (company 'A' supply approximately 70,000 homes (anonymous)), 'A' appear in a large number of interviewee comments. It was suggested that 'A''s focus was on the RHI rather than the heat strategy in

general (24). This is perhaps because the RHI is more focused on off-gas-grid homes which is company 'A''s main market and the scheme was specifically designed to displace higher carbon fossil fuels such as those used off the gas grid (11).

Policy episode 4 highlighted the behaviour of company 'A' explaining that they had lobbied in order to stop the RHI being funded through a levy on fossil fuels which could affect them. As well as publishing research (highlighted in policy episode 4 around the costs of the RHI), interviewees also explained that 'A' had attempted to negatively frame renewable heat technologies. One interviewee explained that 'A' had publicly negatively framed the performance of heat pump systems (31) and it was also suggested that 'A' had even publicly attacked the performance of oil heating systems in order to reduce public confidence and Government support for oil heating (anonymous). Another interviewee suggested that 'A' also publicly questioned the sustainability of biomass heating[34], a topic on which 'A' released a report titled 'Biomess' which has since been removed from their website (11). However, grey literature confirms the existence of this 'Biomess' report which was reported in the Telegraph newspaper in 2009; the media reporting of this information in the Telegraph also suggests 'A' was looking to raise the profile of renewable heat issues and 'A's specific concerns (reference not included to maintain anonymity).

Interestingly, despite previous publicly raised concerns with bioenergy, both the oil heating sector and the liquefied petroleum gas sector have since come out in support of using bio-energy (bio-diesel and bio-LPG respectively) for heating as this is seen as a way to decarbonise heat while not requiring new appliances (Oftec, 2017; UK LPG, 2017). This more recent support for bio-energy by company 'A' was recognised by a number of interviewees (6, 29, 38). This change in approach by company 'A' suggests that the company has moved from a lobbying position which looks to stop change to an approach which attempts to ensure that the approach to decarbonisation suits the company's interests.

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[34] This is not to say that there are not potential sustainability with biomass heating but to highlight the activity of company 'A'.

The approaches used by company 'A' for attempting to affect policy change by using aggressive influencing approaches are explored in more detail in section 10.4 which considers 'style', as these appeared as key tactics for attempting to influence heat policy. This aggressive approach could be considered linked to the third face of power, with company 'A' attempting to shape preferences in order to affect outcomes. Company 'A' could also be seen to be attempting to set the agenda (the second face) through the publication of reports and their promotion in the media. However, as there are no specific policy wins highlighted from this research by 'A' but they have clearly been attempting to lobby, the success of this more aggressive and overt approach appears, at least in this case, limited.

9.1.2.2 Gas Distribution Networks

The gas distribution network companies were mentioned by a large number of interviewees as being involved in UK heat policy debates. This is unsurprising considering that 84% of GB households are connected to the gas network (Dodds and McDowall, 2013) and the network is a major heat infrastructure asset.

Interviewees suggested that the gas network companies had actively attempted to sow doubts about the idea of electrification of heat, criticising the heat strategy and framing heat pumps as poor forms of heat provision; they had apparently used reports written by consultants to attempt to do this, such as the Delta ee pathways for Heat (Delta ee, 2012) (anonymous, 39). The gas network companies had also pushed and highlighted the 'peak heat' argument, suggesting that because of this issue, electrification was not a good strategy for decarbonising heating (9, 25). Both the production of the Delta ee report and the promotion of peak heat was highlighted in policy episode 10 and this episode shows an element of success by the gas networks in making a case for a greater use of gas (at least in the shorter term). Interviewees also suggested that the gas networks had supported technologies which supported the continuing operation of their businesses such as biogas, biomethane and hydrogen (7, 13, 39).

The future of the gas system and heating is recognised as being an important issue for Ofgem's regulation of the gas networks (5). It was recognised by the

networks that if the overall context was that the gas network wouldn't be there in 2050, as suggested by DECC's 2012 strategic framework document (DECC, 2012e), that would have had a major influence on network regulation and the new price control regime for the gas networks which came into operation in 2013 (Ofgem, 2013) (anonymous). The regulation of the gas networks could have had included a much greater focus on decarbonisation, potentially reducing allowed investment levels in the gas network which would have a negative impact on network company finances. According to one interviewee from a gas network, the strategy to push new sustainable forms of gas was a result of the upcoming price control review:

> *'I don't think we were particularly well prepared for it* [the Ofgem Gas Distribution Price control review RIIO-GD1] *, I think it came down to an intuitive strategy rather than something which was more rationally determined, I think it was probably some very clever people at the very top saying 'we've forgot we can make gas renewable''* (anonymous)

It is certainly the case that there may be some potential for the decarbonisation of heat using lower carbon forms of gas. However, there are major uncertainties on the potential scale of and role for low carbon gas and it is far from clear that the complete decarbonisation of the UK's gas grid is even possible (Speirs *et al.*, 2017).

Another interviewee believed the gas networks framed the idea of heat primarily as a consumer issue in order to promote maintenance of the system in its current form:

> *'what they do is that when one goes to meetings about heat someone from the gas networks or the energy networks or somewhere, they will usually say something about how we've got to think about the consumer, that's how it masquerades, 'we've got to think about the consumer, the consumer values all these sorts of things, cheap convenient instantaneous, easily changeable and I think we've gotta value their perspective in these changes, we've got to take them with us,' by which they mean don't do anything yet'* (40)

This specific frame around consumers has been highlighted a number of times and is considered in more detail in section 10.2.5.

Interviewees recognised the gas networks as being important incumbent actors during the development of UK heat policy, particularly around the Government's long term view of heat. The previous chapter also recognised that the gas networks were clearly involved in policy episode 10 which saw an increased role for gas in the early stages of heat decarbonisation and suggested that the gas networks had been partly successful in driving this change. This success appears primarily linked to the provision of evidence to Government which could be seen as being linked to the third face of power around the shaping of preferences and also the fourth face around the power of knowledge. Highlighting the so-called 'peak heat' issue and issues with consumers could also be seen as a form of framing and this is considered in more detail in section 10.2.

Overall, the UK gas networks companies are perceived as relatively powerful actors and appear to have used their power to have some success. It appears that since interviews took place, gas networks have maintained their activity around heat decarbonisation policy. Recently, work specifically on incumbency in the UK heat sector has shown that the gas distribution networks have been one of the most politically active parts of the heat sector and have in particular been strongly promoting ideas of decarbonising the gas grid with low carbon forms of green gas (Lowes *et al.*, 2018b).

9.1.2.3 National Grid

National Grid is a private company which owns gas distribution networks[35] as well as gas transmission networks, electricity transmission and gas and electricity system operations (National Grid, 2015). The company was mentioned by a number of stakeholders in relation to power and the development of UK heat policy and clearly has a number of interests across both gas and electricity sectors. As discussed in the previous chapter (section 8.10), heat system modelling commissioned by National Grid was adopted by

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[35] National Grid PLC previously owned the entirety of National Grid Gas Distribution which was the UK largest gas distribution network. In 2017 National Grid PLC sold 61% of its share of the company and the company has since been renamed 'Cadent' (National Grid, 2017)

DECC in their 2013 heat strategy, 'Meeting the Challenge', document (DECC, 2013k). National Grid had initially used this modelling to explain to DECC that there was an issue with peak heat and that the full electrification scenario could be very expensive. While civil servants recognised National Grid's vested interest, it was still seen as a valid point that a number of different people could have made (24).

It was however suggested by a number of interviewees that National Grid is influential and that their modelling and their annual 'Future Energy Scenarios' '*puts them in quite a strong place*' because of their ability to shape the energy debate (anonymous). Another interviewee explained that National Grid frame arguments based on their importance and role in the energy system, in the interviewee's words, the '*you need us*' frame:

> '*They've [National Grid] got a lot of power. So the Government's got to talk to the Big Six, well God they have to talk to National Grid. Without National Grid on-side, everything stops.*'
> *(anonymous)*

Another interviewee mentioned their '*crazy biomethane projections which still reverberate today and still get quoted*' (anonymous). These projections suggested that in a stretch scenario, 48% of the UK's domestic (household) gas demand could be met by gas produced from biogenic sources by 2020, however this relied on all waste being fully segregated and all being treated by either anaerobic digestion or gasification (National Grid, 2009). In the Committee on Climate Change's 2011 Review of Bioenergy, the Committee recognised that the role of bioenergy in decarbonising domestic heating was likely to be very limited due to the limited availability of bioenergy resources and the optimal use of the limited bio-resources available would be in industrial heat uses (Committee on Climate Change, 2011).

Despite the fact that the National Grid biogas projections were described as '*crazy*', they have been used as a data source for energy system modelling work by the Energy Networks Association which represents gas and electricity networks (Redpoint Energy, 2010). This provides a good example of how information can be repeated and institutionalised becoming knowledge and provides an interesting example linked to the fourth face of power where ideas

and knowledge are repeated throughout society by individuals. Although this example highlights how knowledge can be repeated, there is no evidence from this research that the Redpoint scenarios have been seen as credible or influential.

While it is apparent that National Grid did actively seek to promote lower carbon gases and the peak heat argument in order to attempt to maintain a future role for their gas network, an interviewee from National Grid explained that if the evidence had shown something different, they would have taken a different direction (anonymous). It is difficult to see exactly what the role or even interest of National Grid in heat policy is because of their energy system wide role. The energy system model which was eventually used by DECC for its heat strategy work was apparently produced by 'National Grid' group rather than gas parts of the business (Redpoint Energy, 2012). It is however clear that National Grid attempted to promote the role of their gas assets throughout the development of UK heat policies and interviewees saw them as an actor with some power in the heat policy debate. Similarly to the gas networks mentioned in the previous section, the approaches used by National Grid can be associated with attempting to shape preferences and linked to the use of knowledge (the third and fourth face of power respectively).

9.1.2.4 *Worcester Bosch*

Worcester Bosch was mentioned by a number of interviewees as a company which has been active in the UK heat policy network. The company, which is a UK brand in the thermo-technology division of Bosch, predominantly manufactures gas and oil boilers (Bosch, 2015).

During this research, Worcester Bosch has been accused of opposing the introduction of condensing boilers (20) (policy episode 1) and separately attempting to influence the sustainable heat debate in order to maintain their business of selling fossil fuel boilers (20, 31, 39). A civil servant in DECC explained that despite originally supporting the use of sustainable heat systems, this support was reduced and '*NAME REDACTED* (representative of Worcester Bosch) *'has really started kind of anti, an anti-heat pump sort-of-thing going on*' (23). This approach of attempting to damage other technologies has been highlighted elsewhere in this research with attempts by company 'A' described

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in section 9.1.2.1 to attempt to damage the reputation of biomass, oil and heat pump heating technologies. Policy episode 11 also saw attempts by the ground source heat pump industry to damage the reputation of air source heat pumps and ASHP tariffs were reduced (though not necessarily linked to the work of the GSHP industry). Like with previous actors in this section, this approach of attempting to shape the preferences of policy makers in order to shape policy outcomes appears to be linked the third face of power whereby actors look to shape the preferences of policy makers by attempting to affect their perceptions of (potentially) competing technologies.

Interviewees also specifically suggested that Worcester Bosch was attempting to block policy change in order to protect its UK business:

> *'Anonymous: Take a closer look at Bosch, and look at where they make those renewable technologies.*
>
> *RL: Well they're not made in the UK…*
>
> *Anonymous: They're certainly not, certainly not and they've got two factories, one in Worcester and one in Derbyshire, one in Derby, one of them makes gas boilers and the other one makes oil boilers and irrespective of being part of the wider Bosch group, if we moved to a market where there was a nose dive in the sale of gas and oil products, what would happen to those factories and the jobs of the people who are employed…So I don't know that it's always a case of people acting in the best interests of their corporate masters. They employ full time NAME REDACTED to just keep dripping negativity into this agenda wherever they can so they say they're pro-renewables but when you look at what they actually advocate, I think that's questionable.'*

Another interviewee made similar comments suggesting Worcester Bosch '*talk a good game in public but behind closed doors do everything they possibly can to not have to change their business models*' (39). Two interviewees also suggested that Worcester Bosch has a strategy of suggesting that Government pushes back decisions further into the future with the aim of protecting their business in the short term (20, 39). There is nothing highlighted from interviews to suggested that Worcester Bosch actually caused the Government to do this.

An interviewee from Worcester Bosch explained that they did sell solar thermal systems and heat pumps but because of the design of the RHI, only biomass had done well under the scheme and went on to describe energy policy as '*a bloody nuisance*' (17).

Although Worcester Bosch has been recognised for its negativity towards change, one civil servant explained (without providing further information on why) *'…no-one's really listened to them that much…'* (23) and so in the view of that civil servant their impact was limited. With regards to the introduction of condensing boilers in policy episode 1, Worcester Bosch were accused of opposing the introduction of condensing boilers and if that was the case, then they clearly were not successful there either. While Worcester Bosch may have been active within the policy network, their actual influence on policy seems limited from this research. Grey literature regarding the behaviour of Worcester Bosch at the time before the interviews is limited however, recent work has shown that Worcester Bosch continues to promote heat decarbonisation options which maintain the need for gas and oil boilers (Lowes *et al.*, 2018b).

9.1.3 Lower carbon heat actors

Companies, organisations and individuals involved with lower carbon (or more sustainable) forms of heating emerged from interviews as another important group of actors. This section briefly considers some of these actors highlighted from the analysis and the following subsections then considers specific actors who were suggested to be particularly involved in heat policy.

Firstly, with regards to biogas and biomethane, The Anaerobic Digestion and Bio-resources Association (ADBA) were recognised by a number of interviewees as being important for the development of support for biomethane and biogas in the RHI (9, 11, 14). It was also recognised by civil servants in both DECC and Ofgem that their role and their approach created a very good working relationship which was beneficial for both sides (23, 26, 34). However, the key policy changes which supported biomethane recognised in policy episode 13 were not attributed to ADBA but to landowners with connections in the House of Lords. It is of course possible that these House of Lords connections were associated with ADBA which was initially set up by Liberal

Democrat Lord Rupert Redesdale (ADBA, 2017) however grey literature has not provided any specific evidence regarding the role of that specific peer.

There were also a number of comments regarding the Association for Decentralised Energy (ADE, formerly The CHPA). A number of interviewees recognised that the ADE was often present within the heat policy network (5, 15, 23, 26, 30, 36), and like ADBA the ADE provided useful information to Government (23). However, as described within policy episode 8, whilst the ADE believed they had influenced heat policy, their impact on policy was not confirmed by policy makers. It was recognised that they have had some influence on heat networks policy, leading the development of the voluntary heat network code of practice (5) a scheme which was led by The ADE (Heat Trust, 2018) and supported by BEIS (BEIS, 2018e). So, while the ADE has clearly been present in much of the debate around heat policy, this research has not highlighted any major political power associated with them. It is however worth noting that there is significant financial and policy support from Government for the development of district heat networks through the Heat Networks Investment Programme and the Heat Networks Delivery Unit (BEIS, 2017b) and the sector has received increased policy support.

A large number of interviewees recognised the engagement of the heat pump industry on heat policy. However, many of these comments are associated with specific actors and the two key actors, the Sustainable Energy Association and company 'B' (identity protected) are considered in more detail in the following sub-sections (9.1.3.2 and 9.1.3.4 respectively). One interviewee suggested that because the heat pump industry was represented by various bodies including the SEA, the Ground Source Heat Pump Association and The Heat Pump Association among others, they each had their own interests and could never agree and were therefore generally ineffective at influencing policy (23). Linking back to the theoretical understandings of power this potential lack of power from not joining up could also been seen as a lack of intransitive power. These organisations were not working together to meet a shared goal and may have been more successful if they were, by forming coalitions.

The following sections focus in more detail on the activity of actors associated with low-carbon heat who emerged from the interviews as being particularly important with regards to the development of UK heat policy.

9.1.3.1 The biomass industry (and their policy luck)

A large number of interviewees mentioned the role of the biomass heating industry in the development of UK heat policy and there was a general belief that because of how favourably the industry had been treated under the RHI, the biomass industry was powerful. However, the policy episodes didn't indicate any points at which the biomass industry had caused actual policy change (although the episodes did identify that the industry were clearly engaging).

One interviewee from a potentially competing technology suggested that the RHI was '…*definitely influenced by the biomass lobby, to what extent, I don't know*' (16) and separately a civil servant explained that the REA, who represented much of the biomass for heat industry, were both engaged and vocal. However, many other interviewees suggested that the success of biomass had been down much more to the introduction of higher than expected tariffs emerging from DECC's own evidence base (6, 10, 25, 36). Indeed, policy episode 7 explained that the non-domestic biomass RHI tariff had been increased at the time it was introduced compared to when it was consulted on. While according to DECC, the significant change to the large biomass tariff was for reasons of cost effectiveness (DECC, 2011c), it was also the case that the underlying cost database had been updated and suggested that biomass boilers appeared slightly more expensive than they had previously (AEA, 2011) and therefore would receive a slightly higher tariff (DECC, 2011d).

Policy episode 11 showed that the original tariff for biomass heating under the domestic RHI was increased well above the proposed range of 5.2 to 8.7p/kWh up to 12.2p/kWh and this change was also linked to changes made to the underlying evidence base rather than the power of a particular actor. Policy episode 12 saw increased budgets made available for biomass systems in the non-domestic scheme, maintaining tariffs at levels which were higher than they otherwise would have been; while the biomass industry was supportive of this change, evidence does not show that the biomass industry caused this change.

Although the RHI has created significant growth in the use of biomass heating, interviewees suggested that like other actors, the biomass industry had still attempted to influence both biomass policy and the market through attempting to negatively frame other technologies including heat pumps (3, 26). With regards to an individual working in the biomass sector, one interviewee from the

civil service explained '*he would just suddenly fly off the handle in a rage about how bad heat pumps were and how DECC were effectively being criminals for even considering subsidising heat pumps at all of any description*', the civil servant described this engagement as '*odd*' (anonymised). The civil servant went on to that this specific actor had even gone to the time to upload YouTube videos explaining the economics of biomass heat system and the implications for policy. Two other interviewees also mentioned the same actor with both interviewees using the word '*rant*' to describe the communication approach of the actor in question (anonymous, 11). It appears that the approaches of this specific actor did little to help their cause and may have actually reduced their impact and potential to have power by damaging relationships with policy makers. This approach could be linked to ideas of the third face of power around the shaping of preferences of policy makers with an actor attempting to shape their views on particular technologies (apparently not very successfully).

While attempts by the biomass industry could have affected the market, many believed that the success of biomass was simply due to the high level of the tariffs and the fact that biomass was simply better suited to the market than heat pumps in that it could easily replace oil boilers and even be a distress purchase[36] (32, 33, 34, 38). Although the biomass industry wasn't recognised as being particularly successful at influencing policy in the policy episodes considered in this research, it has been suggested that as the biomass market has grown as a result of the RHI, its influence on policy and regulation has increased (14, 37, 39). While this growing power hasn't been observed in this research, this could echo issues considered in the previous section on incumbents which suggested that the size of an industry gives it a capacity to engage with policy in a way which smaller sectors cannot.

9.1.3.2 The Micropower Council and the Sustainable Energy Association

A large number of interviewees recognised the heat policy involvement of the Micropower Council trade body, which became the Sustainable Energy Association. As discussed previously in policy episode 3, two interviewees (anonymous) associated with the SEA (then the Micropower Council) suggested

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[36] The term 'distress purchase' refers to an unplanned heating appliance replacement due to an irreparable fault.

that they had been very involved in the design of the RHI scheme. It was however not confirmed that the SEA had any actual policy impact despite their involvement.

The SEA was suggested to initially have been particularly supportive of micro-combined heat and power systems[37] and pushed hard for them, but despite some policy success in the form of their inclusion in the Feed in Tariff scheme, only a very small number have been installed (7, 8). The SEA were recognised at the time of interviews as being particularly interested in air source heat pumps (7, 10, 11) although their website shows the SEA has a wide variety of members including large integrated companies, insulation companies and appliance manufacturers (Sustainable Energy Association, 2016). It was explained by a representative from the SEA that they are interested in a range of within building energy measures (20).

One interviewee suggested that the SEA had predicted that air source heat pumps would dominate the RHI and that this prediction had been wrong (11). However, as described in section 2.4.2.2 while ASHPs have had very low growth in the non-domestic scheme, heat pumps have been more successful in the domestic scheme. ASHPs were also the most popular technology under the Renewable Heat Premium Payment (RHPP) scheme (previously discussed in section 2.4.2.2) which preceded the full introduction of the domestic RHI (DECC, 2014a). Interestingly, one interviewee from the civil service suggested that the SEA were closely involved in the development of the RHPP scheme:

> *'Me and NAME REDACTED* (SEA employee*) sat down together and said what are we going to do, we need something and we've got something like three weeks to work out a new policy and the only thing we could do in the time and with the legal vires we had, we had to use existing legal power, was to do a financial support scheme that was like a grant' (26)*

This level of engagement with civil servants implies that the SEA and individuals within it had an extremely good relationship with civil servants regarding the RHI

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[37] These appliances use gas to produce heat and electricity at the same time at a small (often domestic) scale.

and therefore had the capacity to have a great level of power over this area of policy. A number of interviewees recognised that the SEA have used a specific and relatively unique approach to attempt to influence policy based on detailed knowledge of how the UK Government works and the use of evidence. Interviewees also suggested that the Chief Executive of the SEA was a good lobbyist and he understood DECC and the civil service (7, 8, 16, 29). He had a good relationship with DECC (19, 29) as he was able to '*speak the regulatory speak*' (8) which included providing useful evidence (18, 29).

One civil servant suggested that the relationship with the SEA was very beneficial:

> *'the ones that were better at dealing with Government were SEA, again just their approach the way that they became a trusted confidant, so they were being given information that we weren't prepared to give to other people but we also tested things with them quite early doors and we did this with the REA as well so we would have a set of early tariffs which of course were very commercially sensitive...Dave's* [CEO of SEA] *very good at building that trusting relationship so he's very much inside the tent and he does it very well'* (26)

However, another civil servant explained that while their analysis was useful, they were always slightly '*sceptical*' of the SEA particularly as the SEA had only one analyst: '*they're a small organisation compared to the might of central Government and hundreds of fantastic economists*' (23) although of course this comment could apply to many trade associations. Interviewees also recognised SEA's Chief Executive's strong relationship with ministers (16, 29,) however, it was suggested that the chief executive was careful to maintain relationships and not to antagonise civil servants by elevating issues to ministers (29). The provision of evidence to policy makers from an apparently trusted source could be seen as a way of attempting to shape the preferences of policy makers in order to have a policy impact (the third face of power) and the general link to evidence could be seen as being linked to the fourth face of power.

The style of engagement used by the SEA varies significantly from the more aggressive and negative approach described in some of the previous sections

and the issue of the style of advocacy is discussed in further detail in section 10.4. However, despite wide agreement that the approach of the SEA and its representatives was positive and that the SEA had a very good and trusting relationship with Government, the policy episodes did not highlight any particular lobbying successes for the SEA.

9.1.3.3 The Renewable Energy Association

A number of interviewees highlighted The Renewable Energy Association as an important actor associated with UK heat policy. The REA featured in policy episode 2 focusing on the creation of the RHI in law and policy episode 12 which considered budget changes which allocated more funds from the RHI for biomass. Interviewees suggested the REA have been particularly focused on biomass heat (11, 12, 21). The REA does have the Wood Heat Association as a subsidiary (Wood Heat Association, 2018).

The REA consider themselves as very influential in terms of the development of UK heat policy (7, 14), with one employee saying '*we're the biggest and most influential in our area*' (14). Another employee explained that their relationship with DECC was so good that DECC would share drafts of regulations with them and no-one else (11). A civil servant confirmed that they had shared consultation documents and tariffs with the REA early but this information had also been shared with the SEA (26).

The views of the REA on their own significance were confirmed by civil servants who worked on both the RHI's development at DECC and its operation at Ofgem (26, 29, 34). One civil servant explained that they '*dealt with REA the most throughout*' the RHI and they were the '*biggest sort of influence*' (29).

Their high level of influence was put down to their sophisticated approach which according to interviewees involved using a number of different approaches together and being extremely collaborative. According to one former DECC employee, the REA had '*positive working engagement with DECC which I think has been very productive, whereas some of the other people have taken an antagonistic towards the policy makers, it's not gonna get you very far…the REA had a very positive way of working* '(23). Another interviewee from DECC suggested that REA employees knew that providing solutions rather than suggesting problems to Government was a good way of working (29).

It was also suggested that the REA also had strong political connections, particularly with former minister Greg Barker, and was particularly skilled at making strong political arguments such as the potential for job creation and economic benefits which could '*push political buttons*' (26).

Overall, the interview data has shown that the REA see themselves and are seen as a particularly important actor linked to UK heat policy and they appear to have had some success in have power over policy change around the introduction of the RHI legislation (episode 1). Having both civil servants and ministers (who are the key actors from Government) in a supportive position could clearly be important from a policy change perspective and this appears to be how the REA have operated; section 9.1.1.2 suggested that the REA had a good relationship with Minister Greg Barker and this section highlights their good relationship with civil servants.

9.1.3.4 Company 'B' (identity protected)

One heat pump company was the subject of a large number of comments in interviews and it was recognised that their CEO was particularly vocal (2, 11, 14, 23, 26, 28, 29). Two main issues came out of the comments regarding company 'B', firstly the perceived aggressive nature of their policy influencing efforts and secondly the role of a member of company 'B''s staff and their involvement in the civil service.

With regard to the particular nature of influencing, interviewees described efforts by company 'B' to negatively describe other technologies (10, 14). This included, as described by the CEO himself, framing other heat pumps as '*cheap Chinese kit*' and playing on fears associated with the high costs of solar PV and the costs associated with the UK Feed in Tariff policy for electricity (10). Policy episode 11 described how the RHI tariffs for certain technologies were reduced but triangulation did not show that this was a result of lobbying by company 'B'.

One interviewee also mentioned that the CEO of company 'B' had attempted to negatively frame biomass combustion technologies and was quoted in a national newspaper article (14). The newspaper article in question includes a quote from the CEO of company 'B' which explains: '*Policy flaws have resulted in absurdly generous tariffs for biomass installations, attracting inexperienced*

entrants to an immature market which does not benefit from any effective regulation' (reference not included in order to maintain anonymity).[38]

It was also reported during interviews, that the conflictual approach of company 'B' was also aimed directly at civil servants and ministers. One civil servant explained that it felt like they were '*at war with NAME REDACTED (CEO of company B)*' (23). The minister at the time Greg Barker is recognised as referring to him as '*Voldemort*', the fictional archenemy of Harry Potter (anonymous, anonymous). Another civil servant explained with regards to company 'B':

> *Anonymous: 'one of them we had a love hate relationship, I think we loved them and they definitely hated us and that was a [location redacted] based company*
>
> *RL: [name redacted]* (company 'B')*?*
>
> *Anonymous: Oh god yes, he's been very nice to me since I left, the guy from there, he's been quite pleasant since I'm no longer in charge' (anonymous)*

One ex-civil servant from the ministerial office responsible for the RHI explained that the CEO of company 'B' would threaten going to the press and causing problems in Parliament and (as a result of a complaint by him) caused an internal investigation in DECC (anonymous). Another interviewee explained that eventually, all communications with the CEO in question had to go through DECC's legal team; however, despite describing him as loud and threatening, the same civil servant explained that actually company 'B' had a '*disproportionate*' impact on policy (without explaining how) for a company of the size (29) as a result of their engagement with policy. However, another explained that '*over time he undermined his position*' leading to a point where staff in Greg Barker's office would recognise his telephone number and ignore his telephone calls (anonymous).

The approaches by company 'B' to influence policy appear primarily associated with ideas of the third face of power and preference shaping. 'B' has attempted

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[38] These comments regarding biomass may have some truth however for the purpose of this thesis, it is the use of these comments as a lobbying tool which is of interest.

to frame other technologies as inferior and used a particularly negative approach to do this. However, the approach of intimidation could also be potentially seen as linked to the first face of power with aggressive approaches potentially giving company 'B' power over the Government. These issues of framing and style of influencing are considered in more detail in section 10.1.

One interviewee also suggested that company 'B''s efforts to influence policy went beyond simple communication but that they attempted to influence policy from within DECC:

> *'there was an industry person who was seconded into the RHI team, initially seconded and then actually became a civil servant on the payroll who had founded a renewable heating company and as part of the code under which ex industry people go into the civil service, it's published code written by the Cabinet Office they are required to conduct themselves in a particular way and they have to put aside their outside interests both current and past as well. So this character put the shares in the company into a blind trust which were then operated by his ex-wife who remained on the board of the company. So that all smelt a bit strange and we were all a bit concerned about this and undue influence being brought to bear and that individual became the subject of I think four consecutive liaison meetings that I had once a quarter with senior civil servants because we could see information being leaked to the company in question, they just knew things that they shouldn't know and we could also see quite clever aspects of the way certain papers were being written and so on which were clearly designed to create a market advantage for that company. And also that character was brought in, because of the civil service rules on this, to work on one specific renewable heating technology because the civil service code says that you shouldn't work on anything that you've got a commercial interest in or recent commercial interest in and the moment he got into DECC he was all over the policy brief that he had an interest in. And that actually slowed down the policy making process because this one individual who was really brought in as a technical advisor had so*

much influence, he was quite a good operator to be fair to him,
had so much undue influence that it was just inappropriate the
way it played out' (anonymous)

Another interviewee also reported this example, explaining that the individual in question, a founder of company 'B' had such good contact with DECC that they let him work for DECC based in vicinity of the headquarters of company 'B', still having very good contact with company 'B' (anonymous). The person in question's 'Linked In' profile shows them leaving company 'B' in 2011 and starting at DECC as technical advisor on the RHI where it explains they worked on increasing the tariffs for heat pumps (references not included for reasons of anonymity, extract shown in Figure 9-1). Information from the UK Government 'Companies House' website which holds information on company directorships, shows the individual stepping down from his role of director at company 'B' in October 2011, the month he started at DECC (reference not included for reasons of anonymity), and since leaving DECC in 2014 he has returned to company 'B' as External Affairs Director (inferred from 'Linked In'). Interestingly at the time that this secondment was taking place, there were reports in the media regarding secondees in DECC and the potential issues and conflicts of interest caused by these sorts of secondments although this did not relate specifically to Company 'B' (Guardian, 2014).

Figure 9-1. An extract from employees linked-in profile with identifying information redacted (Linked-in, 2016)

This approach of trying to influence policy from the inside of Government as a secondee could be seen as linked to the first and second face of power. The secondee's position within the Government gives them aspects of the first face of power where they are able to potentially do things that otherwise may not have happened such as shaping policy advice in a particular way but also sharing information externally. The second face of power may also be at play as the secondee has the power to shape the agenda of policy work, focusing his time on an issue which he appeared to have a personal interest in. This approach of having power does not however seem to be aligned with the civil service code requirement of 'integrity' which is described as '*putting the obligations of public service above your own personal interests*' (HM Government, 2017a).

While company 'B' has clearly been attempting to influence policy, they appear to have disengaged some ministers and civil servants and attacked other industries. Even though some policy changes identified in the policy episodes

should have supported company 'B' the policy episodes do not suggest any specific success by company 'B'.

9.1.4 Other actors

As well as the three main groups of actors described previously, the interview data highlighted the engagement of a number of other actors in the development of UK heat policy. These actors included NGOs, cross-technology trade bodies, consumers and consumer groups.

Only two interviewees mentioned the role of consumers and consumer groups in the development of heat policy. One civil servant interviewee explained that during the development of the RHI, consumers were represented by the Energy Saving Trust on the stakeholder group for the RHI and Feed in Tariff (26). The other interviewee from Citizens Advice, a consumer body, explained that they sit on DECC's domestic consumer panel and advise on any energy issues for consumers including the RHI (30).

A number of interviewees mentioned Non-Governmental Organisations (NGOs) however there does not appear to be any specific policy change caused by NGOs (8, 9, 39, 40) although NGOs were involved with policy episode 2 (the introduction of the RHI legislation). There was also a recognition from interviewees that some NGOs have been particularly vocal regarding the potentially negative impacts associated with the use of biomass (14, 36).

9.2 CHAPTER CONCLUSIONS

This chapter has considered the actors who have been highlighted during interviews as being particularly engaged with the development of UK heat policy. The interview data identified that the UK heat policy network contains a wide variety of participants, however, three main groups of actors have emerged.

The first of these groups of actors are associated with the Government and within this group civil servants and ministers were seen as being particularly important and as identified in the policy episodes, ministers and civil servants have clearly had power in some instances. Ministers and civil servants have power as a result of their institutional position of being inside Government and in this position they are able to do things that others cannot. Civil servants have

the ability to advise and directly communicate with ministers and ministers have the ability to decide on specific courses of policy action. However, this power sits within an institutional context (i.e. how Government works) and while a minister or civil servant may have some power, this power can be constrained by civil servants or ministers other more powerful Government departments such as the Treasury. Ministers also have the ability to set departmental agendas although again, this power is linked to their institutional position and the wider Government agenda.

The role of 'incumbent' regime heat actors was also recognised as being particularly important in the development of heat policy. It was recognised that the size of some of these actors meant they have the capacity to attempt to influence that smaller firms did not. These actors have the ability and resources to use more complicated and sophisticated influencing techniques such as the production of reports and evidence which have been recognised as being particularly important for the development of heat policy. It was also the case that incumbent actors have promoted technologies which protect their own products and business for example when lobbying for 'low-carbon gas' and against electrification. These approaches echo ideas of 'regime resistance' where established players work to attempt to maintain their current role within the socio-technical system (Geels, 2014).

The final group of actors which emerged is 'niche' lower carbon heat interests which included specific companies as well as trade associations. Approaches of these actors varied, with some taking more hostile or forceful approaches and some looking to build trust and provide evidence. The one actor which appears to have had some success is the REA and data on the REA suggested that this organisation took a sophisticated approach which included both political lobbying (of ministers) and administrative lobbying (of civil servants). As was seen in the section on government power, both ministers and civil servants have power in the policy process but their power can constrain one another; focussing on political and administrative policy actors, as the REA has done, may be an important method to increase the impact of actors on policy.

As well as considering which actors have been involved in UK heat policy, this chapter has also considered how the policy influencing behaviours of actors link to theoretical approaches to power. The power of Government actors including

ministers and civil servants can often be seen to be associated with the first and second face of power. This power is linked to much more structural elements of power associated with the privileged position of actors which allows them to set policy and departmental agendas. Incumbent actors, as a result of their size, have the ability and capacity to engage in power activities and much of their behaviour which has emerged from this research has highlighted the production of reports and models and their promotion (and derision) of certain technologies. The behaviour of incumbents is linked to ideas of the third face of power (preference shaping) and the fourth face of power around knowledge. Some of the behaviour of incumbents could be seen as linked to the second face of power as incumbents have been able to get issues and technologies onto the policy agenda. Smaller low carbon heat related actors have similarly used approaches linked to the third face of power around preference shaping and knowledge sharing and have also used more sophisticated approaches combining both political and administrative lobbying. The approaches of incumbents and low carbon heat industries are in general associated with more agent based forms of power although the incumbents, with their increased capacity for engagement, could be seen to have more structural power than the low carbon heat actors.

This chapter has focused on the role or different actors during the development of heat policy and has touched on the approaches used by different actors to attempt to influence policy. Building on these findings, the next chapter considers the key approaches used by actors to (attempt to) shape the development of heat policy.

10 UK CASE STUDY – APPROACHES USED TO ATTEMPT TO INFLUENCE DURING THE DEVELOPMENT OF UK HEAT POLICY: RESULTS AND DISCUSSION SECTION 3

This chapter forms the final part of the UK heat policy case study. While the previous two chapters have considered actual policy changes (episodes) and the associated policy actors, this chapter considers the approaches which have been used by actors to attempt to influence the development of policy. These approaches will be considered in the context of the previous two results chapters in terms of the actual policy change and the actors also involved. The chapter will also link back to the theoretical underpinnings of the thesis in order to see how the approaches to attempt to have power to influence policy link to the theory around power.

As well as being coded by 'what' and 'who', interview data was also coded by the approaches used to attempt to influence the development of policy. It is this 'how' coding of data which forms the basis of this chapter. From the coding of interview data associated with approaches to influence, three key themes emerged, 'knowledge', 'framing' and 'scale/situation'. These themes contain a number of sub-themes within them and these are explored in more detail in the rest of this chapter.

10.1 KNOWLEDGE: THE USE OF EVIDENCE AND INFORMATION

As recognised in chapter 4, the concept of knowledge is recognised as being central to some understandings of power. Clegg (1989, p152) suggests that the fixing of knowledge is the '*accomplishment of power*'. In the faces of power approach, knowledge could be linked to all four faces of power. Someone with knowledge which someone else doesn't have could potentially have 'power over' that actor (the first face). Knowledge could also potentially support the attempts to get issues onto the agenda (the second face). Linked to the third face, knowledge could be used to shape preferences. Finally, in Foucauldian or

post-structural approaches to power (the fourth face), knowledge and power are seen as difficult to separate because knowledge sometimes is power (Haugaard 2012).

Translating some of these theoretical understandings of the role of knowledge within power debates into more applied contextualisations of power within policy research can be more straightforward than one might initially think. Goverde *et al.*, (2000) suggest that one important aspect of power from a political science perspective is around the control of knowledge. From a lobbying and influencing perspective, this could equate to the information being provided by lobbyists to policy makers but this information could be aligned to the interests of an actor looking to influence. For example, a lobbyist from the heat pump industry could suggest that the costs of heat pumps are higher than they actually are in order to increase subsidy levels for heat pumps. Indeed, within research interviews and as explained in policy episode 11, the idea of 'information asymmetries' has been raised; lobbyists may have information which the policy maker does not but which the policy maker needs and therefore the lobbyist has some control over the knowledge. In general, the production, use and value of knowledge has emerged as an important aspect of power in the heat policy process.

Sub-themes related to knowledge are discussed in the following sub-sections.

10.1.1   Consultations

A large number of interview comments related to the Government consultation process and the development of so-called 'impact assessments'. During the consultation process, Government issues a consultation document on a specific policy change, or a number of policy changes, and the consultation includes a number of questions. Consultees can then respond to the questions and the policy suggestions, often providing evidence to support their positions. In this process, knowledge can be provided by actors with the purpose of influencing the Government. Because of the objectivity requirements of civil servants (introduced in section 7.3.1 and discussed in upcoming section 10.1.2.1), civil servants should be basing policy development on the best available evidence[39]. Evidence based impact assessments must be produced whenever the UK

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[39] The difficulties associated with the term evidence were discussed in section 7.3.1.

Government intends to change regulations in a way which can increase or move regulatory burdens (BIS, 2010) and policy proposals must also be consulted on if this is required by existing legislation (Cabinet Office, 2016a).

A number of interviewees described the official consultation process as an important window to attempt to influence Government suggesting that this was a key route to attempt to engender policy change (16, 21, 22, 31, 37). Government internal advice also suggests consultations are an important part of good policy development (Cabinet Office, 2016b) and a number of interviewees from DECC recognised consultations as important. Interestingly however, no interviewees suggested that their engagement in the consultation process had caused any specific policy changes and the policy episodes did not highlight any specific policy changes which happened as a result of a consultation. This does not mean that responding to consultations never results in policy changes, but this research has not shown it to be a way in which actors have had any power over heat policy.

Whilst no policy changes specifically resulting from actors' responses to consultations were identified, the policy episodes do describe the use of consultations by Government and interviews highlighted the perception of actors that they are important. The policy episodes also show that following the consultation process, a number of significant policy changes have been made. For example:

- In policy episode 4, following consultation, the approach to funding the RHI was changed;
- In policy episode 7, following consultation, changes to non-domestic RHI tariff rates were made;
- Policy episode 10 explained that the Government's view on heat decarbonisation suggested a reduced role for electrification of heat in the short term following their 'strategic framework' consultation;
- Episode 11 described changes to domestic RHI rates following consultation;
- Episode 13 described favourable treatment for biomethane compared to what had originally been proposed at consultation.

While this research hasn't highlighted any examples where policy changes have resulted from the consultation process, the consultation process is believed by many to be an important aspect of the development of heat policy in the UK and represents a key aspect of how companies attempt to use knowledge and evidence to influence policy. This lack of obvious impact on policy change as a result of the consultation is possibly because the consultation process is seen by some civil servants as a legal requirement rather than a process with genuine policy development benefits. Policy makers may have already decided on policy approaches and policy may simply be being influenced more strongly by something else. Interestingly, while consultations are often a legally required aspect of policy development, taking notice of responses to the consultations and the contents of impact assessments is not a legal requirement. There is only a very limited academic literature on the role and importance of Government consultations (e.g Binderkrantz et al., 2014) and what does exist says little about the power associated with them. This could be an interesting area for further research around power and policy change.

It should also be noted that while the formal consultation process is formed of the issuing of a consultation document followed by written responses, alongside this formal process, informal activities may also be taking play which may indeed have an impact. One such example would be the gas industry's impact on the Government's view on the potential for increased levels of gas for heat in the short term (policy episode 10). Engagement took place at the same time as the consultation on the heat strategy but appears to have come about as a result of the production of various reports separate to the official consultation. In this example, it appears that the consultation process provided a window of opportunity for Government to be influenced which industry appear to have capitalised on.

When considering the theoretical understandings of power considered earlier in this thesis, using consultations as a way to attempt to have power over policy change could be seen as a way of potentially getting an issue onto the agenda through highlighting certain issues within responses (second face of power). It could also be seen as a way of attempting to shape the preferences of policy makers (third face of power) and with such a strong focus on knowledge, the consultation process could also be seen as linked to the fourth face of power.

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Finally, grey data showed that in one example the biomass industry provided 40 identical consultation responses regarding RHI support for biomass (DECC, 2013i) showing that the industry was working together, this approach of working together in order to (attempt to) increase power, could be seen as linked to ideas of intransitive power.

10.1.2 Information asymmetries and regulatory capture

Following on from specifically considering consultations, many interviewees mentioned or recognised the importance of the provision of evidence to Government and the reliance of the Government on information from private actors for policy making purposes.

Policy episode 10 described the potential impact of evidence produced by gas distribution networks and National Grid which appeared to lead to an increased role for gas in the decarbonisation of heat. As was recognised in this example, the energy system model used by National Grid was actually adopted by policy makers.

Most comments which suggested a Government reliance on industry evidence with regard to UK heat policy related to the RHI. One interviewee suggested that in a time of declining Government spending, where consultants had previously been used to build gaps in the Government evidence base around heat, Government was now going straight to industry instead. It was however recognised that the consultants had previously been going to industry for information and so even under the consultant model, DECC still relied on industry for evidence albeit indirectly (11).

This sentiment was repeated by other interviewees from industry who suggested '*irrespective of who's doing the research, there will be a reliance on industry and the people actually building the plants' (13)* and, '*I don't think there's any other way to do it, especially in the energy sector which is highly technical, very complicated*' *(19).*

Interviewees from DECC who worked on the first stages of the RHI were clear that they relied on industry for information and evidence; two interviewees explained that because there was no international precedent or market intelligence around sustainable heat in the UK, there were no other options (26, 29). According to one civil servant,

*'I think I was conscious there that I was hugely reliant on the
industry to tell us what, to tell us what to do really…whilst you
have to have a critical eye on these sorts of things, it would be
naive to think that lobbying groups and the bigger companies
didn't shape the policy in a certain way' (29)*

One specific example highlighted by an interviewee of what appeared to be the
reliance on a very small number of industry actors was associated with policy
episode 7. This concerned a tariff change for large heat pumps from the point of
consultation to the actual introduction of tariffs: '*I suspect ours might have been
the only numerical evidence or one of a small number for setting the* [RHI] *tariff'*
explained the industry interviewee (2). Grey literature has not been found which
provides any more information of this specific policy change however, this
example shows the potential impact that industry can have on policy when there
is only limited available data and the Government is relying on this data to make
policy.

The cost data underpinning the RHI and the associated tariff levels have been
the subject of previous sections of this thesis. This includes policy episode 7
which saw higher than expected tariff levels for biomass heat systems when the
RHI was opened and policy episode 11 which saw increased tariffs for biomass
systems and reduced levels for ASHPs under the domestic RHI.

When the non-domestic RHI scheme was being introduced, DECC
commissioned consultants 'NERA' to produce analysis for both technology
costs and also potential uptake rates (NERA, 2010). This analysis used
'stakeholder feedback' to produce its analysis and was also based on previous
evidence produced by NERA alongside consultants AEA considering the supply
cost curve for renewable heat which itself also used stakeholder feedback
(NERA/AEA, 2009). In 2011, DECC commissioned AEA to produce updated
cost data in advance of the introduction of the RHI scheme which again used
stakeholder data and interviews (AEA, 2011) and it was as a result of this
analysis that the costs for the renewable heat technologies had changed when
the scheme opened (DECC, 2011d).

The initial tariffs for the domestic RHI scheme (which as discussed in policy
episode 11 were quite different to what was originally consulted on) were also

based on the 2011 AEA analysis and this analysis was built on by 'sweett consultants' who again used stakeholder analysis to further develop the tariffs (sweett, 2013). Overall for the RHI, in both elements of the scheme, there has clearly been a reliance on industry data to set the tariffs for the RHI scheme albeit via consultants.

Another specific RHI policy change which was discussed during policy episode 14 was the biomass budget increase in the RHI in 2013 which was underpinned by industry data (14) being collected by a civil servant with the remit of specifically gathering market data (23). As explained already, a civil servant working on the RHI at that time explained that with regard to the use of industry data in this example '*there was quite a big feed-back loop with industry*' (27).

Rightly or wrongly, there has been a clear reliance on industry data during the development of UK heat policy during the period of this research and this reliance implies a level of power over the Government by industry. Through the provision of evidence weighted towards the interests of actors, this information asymmetry could allow industry actors to exhibit the first face of power in getting Government to do something it would otherwise not have done. It is clearly the case that industry data was relied upon for the development of the RHI and the tariffs for biomass combustion were increased to a level which was too high leading to rapid biomass deployment (as described in section 2.4.2.2). However, it is not possible to attribute these RHI policy changes to specific industry actors. It is also the case that in this example, the Government altered tariffs to increase the deployment of more cost effective technologies (including biomass). As with consultations, more granular analysis of the data (and the production of data) used to underpin the RHI (or policies in general) could provide interesting evidence on the role of industry data in causing policy change and may be able to provide more specific recommendations for how policy makes could gather and treat data. It is however recognised that in a competitive energy market such as that in the UK, industry will most likely have better knowledge on certain elements of the energy system, such as costs, than policy makers.

The reliance on industry data is sometimes referred to as regulatory capture which at its widest definition concerns '*the process through which special interests affect state intervention in any of its forms, which can include areas as*

diverse as the setting of taxes, the choice of foreign or monetary policy, or the legislation affecting R&D' (Dal Bo, 2006, p203) but using a more narrow definition concerns regulated monopolies (such as networks) manipulating the regulators who are supposed to be able to adequately regulate them (Dal Bo, 2006). A full review of the concept of regulatory capture in this instance is not necessary but is available at Dal Bo, (2006).

Overall, the reliance on industry data such as cost data and energy system modelling has in places affected the development of UK heat policy and using evidence can be seen as a key approach to influence. However, attributing specific changes to heat policy due to regulatory capture and a reliance on industry data is not a simple task and in general, a much more granular level of enquiry is required, for example investigating very specific policy or regulatory changes.

Linking back ideas of information asymmetries to theoretical approaches to power, it could be suggested that those with knowledge required by policy makers have power over policy makers (the first face) as without the relevant knowledge, policy can't be made. Information asymmetries could also be seen to be linked to the second face of power, as those with information which policy makers do not have, may be able to get ideas on the agenda. The reliance on industrial evidence could also mean that the preferences of policy makers get shaped as a result of that evidence (third face). Ideas of the production of knowledge to suit interests and the reproduction of this knowledge also link closely to ideas of the fourth face of power around how knowledge and ideas are reproduced.

10.1.2.1   *The objectivity of civil servants and helping with evidence*
This section is closely linked to the previous section on regulatory capture and information asymmetry. While the interview coding highlighted this as a specific issue, many of the issues theoretically are the same and so it is treated as a sub-section.

A large number of interviewees recognised the importance of objectivity and the use of evidence by civil servants (terms introduced in this context in section 7.3.1). The 'Civil Service Code' which explains how civil servants must act in their role explains under the section 'Objectivity' that:

'*You must:*

- *provide information and advice, including advice to ministers, on the basis of the evidence, and accurately present the options and facts;*
- *take decisions on the merits of the case;*
- *take due account of expert and professional advice.*

You must not:

- *ignore inconvenient facts or relevant considerations when providing advice or making decisions;*
- *frustrate the implementation of policies once decisions are taken by declining to take, or abstaining from, action which flows from those decisions*'.

(HM Government, 2017a)

Almost all comments on this issue suggested that the civil servants working on heat were objective and used evidence appropriately. One interviewee (from a trade body) suggested that compared to other EU countries, the UK civil service was so objective that other countries found it amusing that even ministers struggled to pass policies without evidence (19).

The civil servants themselves saw objectivity as central to their role (24, 26, 28) and one civil servant explained that ensuring the quality of data and evidence is becoming more important in the UK civil service (27). It was also suggested that the GB RHI was not particularly political and had stayed '*under the radar*' and generally away from politics, allowing it to remain generally objective in the hands of civil servants although still obviously affected by the wider context of institutional goals (23). It is however of course the case that the actual funding of the RHI scheme was a political matter and is the subject of policy episode 5.

Because civil servants (according to a DECC civil servant) '*are often struggling to evidence things*' (27) but evidence is seen to be so important for civil servants, this reliance on evidence can mean that those looking to influence policy can exploit this reliance (as explained in the previous section regarding information asymmetries). Interviewees from industry recognised the need to provide DECC with evidence, studies and real project information in order to drive policy change (13, 14, 15). A good example of this specific approach of

playing to civil servants' requirements for evidence is the provision of a 'mock impact assessment' by the SEA trade association to DECC (the SEA were discussed previously in section 9.1.3.2). It should however be noted that the policy episodes did not highlight any specific examples of those looking to influence providing civil servants with any incorrect evidence; it did however show that evidence was being provided by actors which suited their own interests such as the provision of evidence which specifically considered (and highlighted) the role of gas discussed in policy episode 10. It may therefore be that actors look to influence civil servants by providing 'cherry picked' data and evidence while ignoring or not highlighting evidence which doesn't suit their interests. The capacity of large actors to attempt to influence (as recognised in upcoming section 10.3.1) could therefore mean that policy makers are often exposed to cherry picked evidence.

A number of interviewees commented that while the civil service analysis may be objective or based on evidence, it might not be necessarily well informed (8, 38, 40). This could be down to the provision of incorrect data by vested interests (40), or simply a lack of understanding (8, 25). Two interviewees believed that the potential lack of understanding by DECC within the heat policy debates was linked to a general lack of knowledge associated with low-carbon heat in the UK because of limited knowledge at a national level (14, 21).

Interviewees also believed that Government did not have enough knowledge to set tariff levels under the RHI (15, 18) and this was recognised by civil servants as an issue during the development of the scheme (26, 27, 29). Indeed, throughout this thesis, the RHI tariff levels have been seen as having a number of issues, with significant changes made to both expected tariffs (i.e. in advance of the scheme's opening) and tariffs which are operational (explored in section 2.4). It was however recognised by one interviewee that as the policies have developed, data has been collected and the evidence base is growing (27) indicating that some learning may be taking place.

Building on the previous section on information asymmetries, this section has specifically highlighted the requirement by civil servants to base policy analysis on evidence, an issue which means that those with evidence are important to civil servants and can be powerful. It should also be noted that civil service actors will have their own views, histories and approaches to working which are

likely to affect policy change, however the actual impact of these psychological issues on policy change has received only limited research focus (see Cairney and Kwiatkowski, 2017) and is beyond the scope of this research.

10.1.3   Consultants and their models

The previous sections partly considered the reliance of Government (heat) policy making on industry data and as was discussed, much of that data came to Government via consultancy firms such as 'NERA' or 'sweett group'. The interview data highlighted that these consultancy firms have formed an important part of the UK heat policy development process, particularly in relation to the RHI and that the analysis produced by these consultancies can have real world impacts such as on the deployment of renewable heat technologies. This section therefore considers the role and behaviour of these consultancies and how their position can link to ideas of power.

A number of interviewees specifically criticised the NERA/AEA work on the costs of renewable heat technologies discussed in section 10.1.2 which was used to set RHI tariffs (10, 11, 32). Policy episode 7 considered the setting of the original non-domestic RHI tariffs which at consultation had been based on the original analysis by NERA/AEA (2009) and NERA (2010); the original RHI tariffs were then updated based on further analysis by AEA (AEA, 2011). One interviewee suggested that the NERA/AEA model had been produced by an inexperienced consultant who had primarily used publicly available data from the internet (implying that this was unreliable) but explained that because it was branded by a consultancy, DECC accepted its findings (10). The interviewee was implying that consultants have a level of legitimacy with DECC even though the actual analysis may not be reliable[40]. Another interviewee from a trade association believed that the original report by NERA and AEA into 2020 renewable heat targets (and on which the RHI tariff analysis tariff was also based, NERA/AEA, 2009) became so important within DECC that the report effectively became a target for the expected splits in renewable heat and eventually the tariff degression system was based upon these numbers (11):

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[40] It may of course be that civil servants can blame consultants if policy does go wrong

'...a scenario becomes a target, becomes a forecast and over time an illustrative breakdown became a technology prediction for 2020 and even worse particularly when there was pressure on cost control became a prediction for each individual year and then essentially, the triggers, the caps if you like were built around that prediction so that is putting an awful lot of weight on a model which:

One, acknowledged it had huge areas of uncertainty to start with and

Two: was really not ever intended to be able do that' (11)

The previous quote highlights how this one piece of analysis from a consultancy appears to have become an enduring element of RHI policy design despite clear uncertainties around the costs of renewable heat in the UK. A civil servant who was the head of the RHI while it was being introduced, accepted that the NERA/AEA work had been used for policy development including for developing expected heat deployment pathways in spite of the fact that there were issues with the analysis; they did however explain that it was the best evidence they had (26). Another civil servant working on the RHI recognised that the originally suggested deployment and mix of technologies didn't arise but suggested that the inclusion of further industry data had subsequently strengthened the knowledge base (27) again indicating that some learning by Government may have taken place.

However, expanding the use of the already questionable data further and despite the recognised limitations of the analysis, the Committee on Climate Change also used the same data, extending the renewable heat cost model with some modifications, out to 2030 for their fourth Carbon Budget analysis (6) (NERA/AEA, 2010). Further still, the NERA/AEA modelling for the fourth Carbon Budget was then used as a baseline for further work by consultants (on behalf of the Committee on Climate Change) investigating the options for decarbonising buildings all the way out 2050 (Element Energy and AEA, 2012). Clearly, this 'evidence' has had an enduring impact on policy development and energy models looking out to 2050 despite the fact that the underlying

assumptions regarding the costs of renewable heat were highly uncertain in light of limited UK experience.

As well as producing cost data, consultancies working on heat decarbonisation have also been involved in the development of energy system models to support policy development. The sharing of models has already been discussed previously in policy episode 10 with regards to the use of a model originally used by National Grid and then used by DECC during the development of the heat strategy. Policy episode 10 also described the development of a heat system model by consultants Delta ee on behalf of the Energy Networks Association as part of their gas advocacy work which was then used by a different trade association with similar interests. In this example, the ENA used the consultancy to produce a report to consider changes in heating technologies up to 2050 (Delta ee, 2012) and The Heating and Hot Water Industry Council used the same modelling tool for a potential heating technology pathway looking towards 2030 (HHIC and Delta ee, 2013). As a result of being based on the same assumptions, both models produced similar results which reflected the interests of the respective trade associations, showing a much greater role for gas used for heating than had been shown in the Government's own modelling.

Consultancies and their analysis, which includes data gathering and the development of energy system models, have had an important role in the development of UK heat policy and this appears to be partly, as identified in section 10.1.2.1, as a result of the reliance of civil servants on evidence. Two key issues regarding consultants and models have emerged from this research linked to power. The first relates to the data which is used to make policy, specifically in terms of UK heat policy, the data which underpinned the RHI schemes (including NERA/AEA, 2009; sweett, 2013). The original data was seen to be unreliable and as a result has had some impact on the RHI tariffs and potentially therefore RHI deployment. While this research has not shown that actors have necessarily had power to affect this data, it is apparent that the consultants have relied on industry sources for cost data.

The second key power issue is to do with the reproduction of evidence. Because of the limited UK evidence base on sustainable carbon heating, evidence is precious. The evidence or knowledge that does exist is often

reproduced or integrated in further research meaning that potentially incorrect assumptions are reproduced. This research has highlighted the reproduction of extremely uncertain technology costs and the reproduction of energy system models. This idea of reproduction of evidence and knowledge links strongly to ideas of the fourth (poststructural) face of power as ideas and knowledge become reproduced and engrained across individuals; this also links strongly to ideas of more structural elements of power linked the reproduction of 'ideas'. Interestingly, while these reproductions of knowledge appear as more structural rather than agent based elements of power, i.e. no one is specifically promoting the reproduction of this evidence in order to actively influence policy, it was actors originally responsible for the production of this knowledge (such as energy system modelling); this implies that historical agent based attempts to have power can become a more enduring and structural element of power.

10.2 FRAMING: THE APPLICATION OF IDEAS AND MYTHS

This section forms the second part of the 'approaches to influence chapter' and considers the use of framing as an approach to influence. As discussed in section 5.2, ideas have been seen as an important aspect of the power associated with policy change. While the concept of ideas and power may seem abstract, one way in which ideas are actively involved in the development of policy is through their use as policy frames by those looking to influence policy. Those looking to lobby can attempt to have power by framing their policy requests in a way which is expected to appeal to the policy maker making the policy maker more likely to be amenable to the proposed lobbying request.

The concept of framing was introduced in some detail in section 5.2.1 and so requires little introduction here. Quite simply framing can be considered as an approach to attempt to influence in which those looking to influence shape their communications in a way which are aligned with the preferences of policy makers in order to make their suggested policy changes more salient with policy makers. For example, a heat pump manufacturer could ask for policy support for heat pumps while suggesting that heat pumps are good for reducing energy imports, this would therefore be framing their policy request around energy security issues. Similarly, lobbyists could frame their lobbying around other salient Government goals such as economic growth.

The interview data coding process coded interview data relating to the concept of framing as well as around the use of specific frames. The remainder of this section and the sub-sections within it consider the results of this coding. Section 7.4.3 which considered the analysis of framing introduced a typology for considering ideas and influence which suggested that ideas can have influence on policy as mediated influence (where existing ideas are re-used by actors), unconscious influence (where ideas are used but it is not clear where the idea has emerged from), adoptive influence (where existing ideas are actively adopted), distorted influence (where ideas are deliberately misrepresented) or cumulative influence (where ideas have grown, emerged and developed over time) (Shorten, 2013). As well as considering the use of certain frames, this chapter uses Shorten's (2013) typology to consider the type of framing.

10.2.1   General views on framing

A large number of interviewees recognised the use of framing by those looking to influence policy, with some interviewees suggesting that everybody frames their arguments (2, 12). The utilisation of particular frames was considered audience specific with actors using different frames for different target audiences depending on the interests of the audience (4, 11, 19). A number of interviewees also suggested that their framing had changed with the change of Government in 2015 and framing was more focused around the cost-benefits of a particular policy change (9, 14, 16, 28). It was also suggested that, under the Conservative administration at the time of interviews, using the EU Renewable Energy Directive Target for 2020 as a frame for promoting renewable energy was no longer useful considering the Government's less positive view of Europe (11, 39). The use of specific frames for particular audiences which may change over time implies a context-specific, considered and strategic approach to framing by those looking to influence. These approaches also suggest ideas of 'adoptive influence' where frames are adopted by actors depending on their potential value.

The use of framing was recognised by civil servants and it was even supported by civil servants if they believed it could drive policy. One civil servant even explained that they had asked industry to highlight employment and economic growth benefits that their proposed policy changes would cause (23):

> *'we would help them with a hint, we would get back to them and*
> *say that's all very interesting but Greg Barker's really gonna*
> *wanna see long term economic plan in there somewhere, if you*
> *can give him something that he can hook onto using in a speech*
> *that says if we do this this is good for our long term economic*
> *plan, the sort of stuff that politicians want to hear...' (23)*

Interestingly in this example, use of the phrase 'long term economic plan' was encouraged and this is a phrase which, during the 2010-2015 Coalition Government had been used repeatedly by the Government including in many interviews and speeches to the point where it was being described as '*a slogan*' (Telegraph, 2015).

Another civil servant described the centrality of the use of framing in policy influencing:

> *'Well if these people are lobbyists then they wouldn't be doing*
> *their job if they weren't listening to what the politicians say and*
> *since David Cameron has already made a speech about the*
> *importance of innovation and harnessing the power of the markets*
> *to meet our climate change objectives, then I would expect a good*
> *lobbyist to come to me and say this is all about innovation and*
> *harnessing the power of the market because they'd be a bit daft if*
> *they didn't say that.' (24)*

In both of the examples described above, it appears that civil servants are, by setting objectives or laying out ideas, creating or at least recognising frames which will have political salience.

As described previously, the interview data coding considered the different framing approaches recognised as being used by actors during the development of UK heat policy. It is recognised that there is a level of subjectivity in this process as the researcher has both selected the frames which are apparently important in the first place and then further allocated references to these frames. Furthermore, the position of the researcher as an interviewer may also have an impact on the coding and results with interviewees potentially attempting to frame their comments during interviews to reflect their own position and influence the researcher's understanding. Whilst it

is recognised that this aspect of the coding has some difficulties, in order to mitigate the risk of subjective impacts, the frames emerged from the coding of interview data and were not pre-selected; all references to these frames were coded to these frames as accurately as possible. Interviewees were also asked explicitly about their knowledge of framing during interviews in order to attempt to gain straightforward views from actors across the heat sector on framing.

The frequency of the number of references (highlighted by the coding) to particular framing approaches or frames is shown as a bar chart in Figure 10-1 (which includes only frames with at least 2 references).
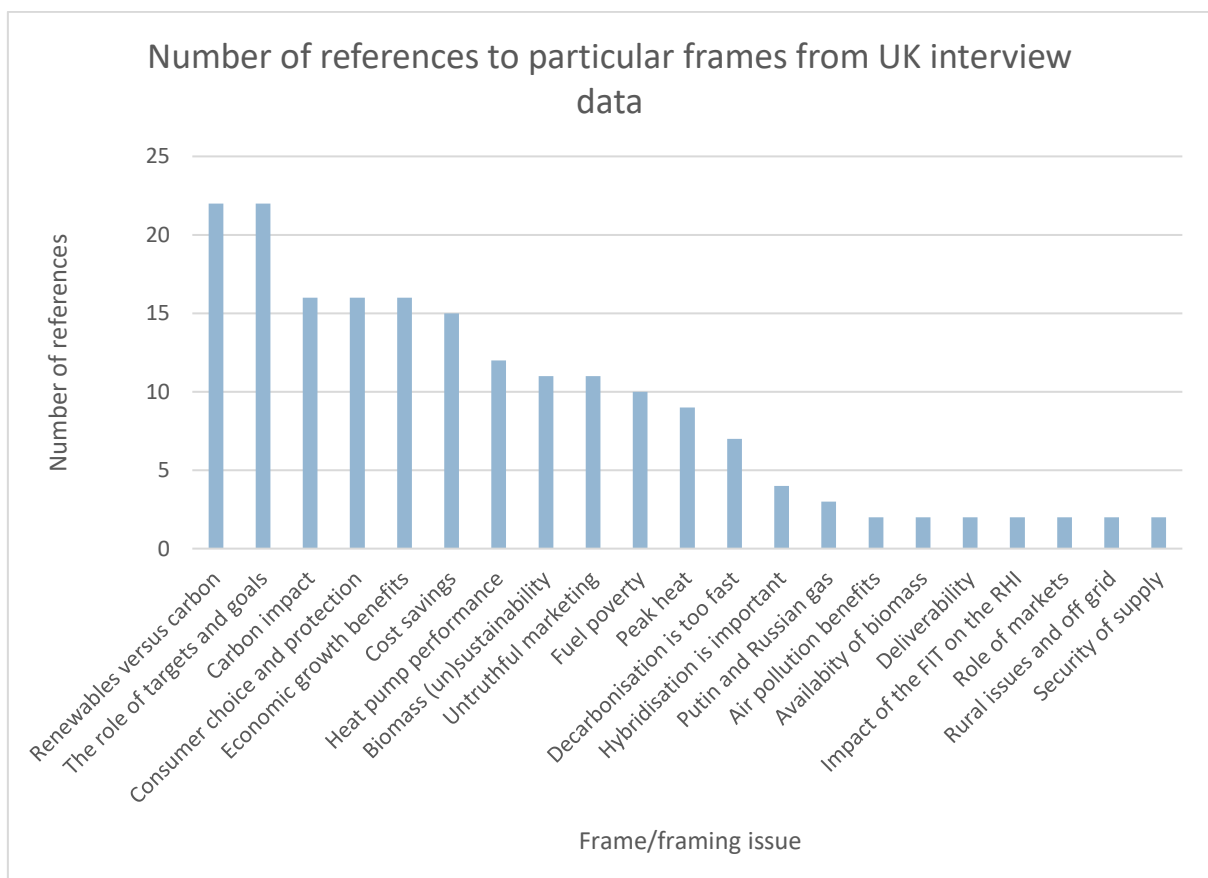
Figure 10-1. Framing issues by number of references from UK interview data for all frames with at least two references sorted by number of references

Some framing approaches occurred more frequently in the coding and overall, the UK interview data recognised the use of twenty nine different frames (some of which were inter-linked). The most frequently occurring frames which were most referenced by interviewees are discussed in the following sub-sections. Readers should bear in mind that some frames are closely related to each other and that some framing issues are particularly complex, for example, as a result

of detailed technical issues. The following discussion sections focus on the actual frames and associated issues in more detail.

10.2.2 Renewables delivery versus carbon reduction

The framing issue which was commented on the highest number of times by interviewees was a complex issue specifically regarding the playoffs between renewable energy delivery versus carbon emissions reduction. The UK has both a 2020 EU target for renewable energy deployment of 15% and long term targets for reducing carbon emissions under the Climate Change Act. However, these two objectives are not necessarily aligned as some technologies classed as renewable may not necessarily be low carbon (e.g. some forms of biomass) and some low carbon energy may not be renewable (e.g. nuclear or even potentially gas when compared to higher carbon fossil fuels). To make matters more complex, a technology which may be classed as renewable may be relatively high carbon now but may become low carbon over time (e.g. a heat pump as over time the electricity grid decarbonises). A more detailed technical description of this issue is contained in annex 5.

The complexity of this issue has been used by actors across the heat policy network to promote specific technologies or approaches with actors using the 'renewable' or 'carbon reduction' element of this issue when it suits them. A number of actors believed that the RHI incentive mechanism has focused on promoting renewable energy rather than reducing carbon (4, 10, 16, 17, 39), hence its focus on biomass heat (17) and this biomass lean has been discussed already in section 2.4.2.2. One interviewee suggested that subsiding biomass heat may help meet the 2020 renewable energy target but because of its relatively high carbon intensity, biomass is an expensive way to reduce carbon emissions and the Government should '*abandon the focus on renewables*' and focus on carbon saving instead (4). In this example, it should be noted that this interviewee primarily represents combined heat and power and district heat technologies rather than specifically renewables or biomass.

Other interviewees highlighted the more temporal aspect of the issue and believed that 'carbon reduction' should be the focus of the RHI and that the scheme should focus on longer term strategic carbon goals such as

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electrification of heat rather than short term carbon savings or renewable heat (10, 16, 17, 39).

The comments suggesting the RHI had not focussed on carbon were generally from actors representing technologies which had not delivered much capacity under the RHI, i.e. not biomass (4, 10, 16, 17, 39). However, actors involved with biomass heating did suggest that the benefit of framing technology as 'renewable' was no longer as persuasive as 'low-carbon' under the current conservative Government (at the time of interview) (11, 14), suggesting that the 'carbon' frame may now be more effective. This change in framing was also recognised in the previous section on framing in general (10.2) and was seen to be linked to the fact that the UK Government had a generally negative view of The EU including European targets for renewable energy.

There was a recognition in DECC that the conflict between renewable deployment and carbon reduction exists and that the civil servants who set tariffs for the RHI have not always engaged with the longer term heat strategy team (24). It has however always been recognised by the Government that the RHI was designed to help meet the EU 2020 Renewable Energy Directive Target for the UK of 15% of energy from renewable sources (DECC, 2011c) and as explained by a civil servant, saving carbon was not the primary purpose of the scheme: '*we'd been honest that if we were not being driven by the EU 2020 targets we wouldn't have designed it the way we did, it was designed purely to meet that 2020* [renewable energy] *target. If you were looking at something purely on low-carbon terms you probably wouldn't have done it like that (26).'*

Although the RHI was designed to meet the 2020 EU renewable energy targets and suggested a possible energy mix previously described in section 2.4.2.2, it has primarily supported biomass, and there is a recognition within Government that the dominance of biomass in the scheme was not the original intention (27) and Government has since modified the scheme to support more mixed technology deployment (DECC, 2016c).

The 'renewables' versus 'carbon' frame is a complicated issue and the evidence shows this complexity has been used by some actors to frame their own products as beneficial to the Government's aims of reducing carbon and

promoting renewable energy, two aims which are not necessarily aligned. The use of framing around specific targets and goals is the focus of the following sub-section.

Overall, the renewable deployment versus carbon reduction frame has been used by actors to frame their own attempts to influence policy depending on whether their technology is classed as 'renewable' or 'low carbon'. This suggests an element of 'adoptive influence' where existing frames are actively adopted. Interestingly with regards to this frame, as the Government's priorities have changed over time, it appears that actors have changed their framing to ensure it matches Government priorities.

10.2.3 Targets and goals

Linked to the previous framing issue but with differences, framing around 'targets and goals' had the same number of references as 'renewables delivery versus carbon reduction' suggesting that this frame is also used widely. Under this framing, those looking to influence policy used frames associated with Government goals and targets to promote their policy interests. For example: you should support our technology because it will help you meet the 2020 renewable energy target.

The UK has legally binding targets for deployment of renewable energy (European Union, 2009), legally binding targets for carbon emissions reductions (Parliament, 2008a) and targets for reducing fuel poverty (HM Government, 2015a) among others. From the interview data, it is recognised that using targets to frame proposals for policy influencing occurs frequently, and these targets are therefore seen to be important for those looking to influence policy.

In the shorter term, the EU 2020 target for 15% renewable energy in the UK is recognised as being particularly important for driving the development and ongoing maintenance of the RHI (5, 11, 17, 40), with some interviewees suggesting that it's legally binding nature made it a particularly powerful frame (39, 40). However, as was discussed in the previous section (10.2.2), some interviewees believed that in general, the renewable energy frame is becoming less useful than framing around carbon reduction.

The carbon target for 2050 and associated interim carbon budgets were also recognised as being a useful way to frame potential policy changes (6). One

interviewee mentioned the role of the Committee on Climate Change who advise Government on carbon budgets and explained that they linked their policy influencing efforts to the carbon target frame and more specifically, the CCC advice around carbon budgets (39).

But it was not just national and international targets but also other aspects of policy which appear to have effectively become targets which are used to frame policy influencing. A number of interviewees believed that the potential technology deployment split of the RHI published before the scheme opened which was based on analysis by consultants AEA and NERA (see section 10.1.3 and DECC, 2011c) had effectively become a deployment target for renewable heat technologies. Companies then used this split to argue for policy change (7, 11) despite the fact that the suggested split in technology was never proposed to be a target (26).

It is clear that those looking to influence heat policy have framed elements of their influencing approaches around Government targets and goals however, whether or not this approach has been successful has not been highlighted by this research. The various and sometimes competing goals for energy means that different frames can be used by different actors as and when a particular goals suits their interests and once again, this particular framing approach appears to be an 'adoptive' influencing approach whereby actors adopt frames to suit them.

10.2.4   Carbon impact

Framing around 'carbon impact' had sixteen references in the UK interview data suggesting it was relatively widely used. This frame refers to ideas around the general carbon savings associated with particular policy choices, rather than specific reference to carbon reduction targets or the playoff between carbon targets and renewables discussed in the previous two sections.

It was suggested by both external actors looking to influence policy and civil servants in Government that focussing on carbon was central to heat policy in general to the point where it was almost a taken for granted frame i.e., if it doesn't reduce carbon there's no point asking for it (23, 25, 39).

A number of interviewees used a slightly different approach to carbon based framing, focusing on the cost of carbon i.e. highlighting options for reducing

carbon emissions most cost effectively (15, 16, 34). Interviewees recognised that the frame around cost of carbon was particularly persuasive with the current Government (19, i.e. the Conservative led coalition) who were promoting policies of reduced Government spending and least cost decarbonisation, an idea that was in the Conservative Party manifesto before the election (20).

While there is no evidence of this frame specifically driving policy changes in the policy episodes considered in chapter 8, clearly some of the development of the RHI has focused on carbon reduction and the development of the heat strategy has had decarbonisation at its centre. Interviewees generally saw carbon reduction as an important frame within the heat policy process and this framing again appears to be linked to 'adoptive influence' as those looking to influence adopt the frame.

10.2.5   Customer choice and protection

The 'customer choice and protection' frame had the same number of references as the 'Carbon impact' frame suggesting it is a relatively important frame. This frame centred on the issue of consumers having choice over their heating system (in the context of decarbonisation potentially meaning that consumers may need to change their heating system).

It was recognised by an interviewee associated with the UK energy regulator that there are major consumer issues with a transformation to a low-carbon UK heating system both in terms of potential cost increases and a need for new regulation around district heating networks (5). With the potential changes to the UK's heat system outlined in section 2.3, there could clearly be significant impacts on consumers. However, the use of this particular frame was generally associated with attempts to influence policy in order to support incumbents and slow down the envisaged heat transformation (3, anonymous, 40). It was suggested that this frame was employed in order to highlight potential consumer issues but this framing ignored other aspects such as long term costs (which may be similar for consumers) and other energy system issues (3). It was also specifically suggested that this frame was used to sow doubt about a more electric heat future (15).

The interview data showed that it was primarily incumbent heating companies which used this frame and this was recognised by the incumbents themselves (9, 16, 18, 38). One non-incumbent interviewee explained: '*someone from the gas networks or the energy networks or somewhere, they will usually say something about how we've got to think about the consumer, that's how it masquerades, we've got to think about the consumer, the consumer values all these sorts of things, cheap convenient instantaneous, easily changeable and I think we've gotta value their perspective in these changes, we've got to take them with us, by which they mean don't do anything yet*' (40).

The link of this specific frame to incumbents highlights framing by a specific group of actors considered previously in section 9.1.2 who appear to have an interest in maintaining the existing system. As identified in policy episode 10, there was indeed pressure from the incumbents to reduce the perceived need for electrification. While the use of this frame by incumbents has been recognised, it is unclear from the interviews whether this framing had any impact on the policy change in episode 10 but it is seen as important. Linking to Shorten's (2013) typology, the particular framing, which has been suggested to be a '*masquerade*' to protect incumbent interests, could be seen as an example of 'distorted influencing' where ideas are deliberately misrepresented or distorted. However, it needs to also be considered that in general, framing is an attempt to highlight certain issues while ignoring others and framing in general could be seen as 'distorting' in some way. The approach to framing in this section may however be more distortive than other approaches.

10.2.6 Economic growth benefits

Framing policy changes around economic benefits for the country received the same number of references during interviews as the previous two frames. This framing approach included suggesting policy changes would create new jobs (8, 14, 23, 29, 36), and suggesting that the policy change would promote economic growth in general (13, 14, 20, 23).

Others framed the economic issue around the UK's international competitiveness (19) or even recognised that threats linked to economic performance could be useful for example suggesting that investment would not happen unless policy was changed in a particular way (15, 29). It was also

believed (by some interviewees from trade associations) that these economic growth benefits would be particularly well received from organisations who represented large number of industries such as the renewable industry in general (14) or the UK's boiler industry (8). It was recognised by one former civil servant that for some policy changes, framing policy changes around the increased jobs frame was so persuasive that it could even trump poor technology choices (36) (although it was not clear that this specifically related to heat policy).

As described in section 10.2 on general uses of framing, civil servants and those attempting to influence heat policy recognised the value of framing policy wants around ideas of economic growth suggesting an element of 'adoptive influence' where the frame has been adopted because policy makers see it as important. However, despite the wide recognition of the use of this frame, the interview data and policy analysis has not shown that this specific framing has had any impact on the development of heat policy.

10.2.7 Cost savings on energy bills

A number of interviewees recognised the use of framing policy influencing around the potential of cost savings, in particular for consumers. This was believed to be a good frame to use because of political concerns around energy costs for consumers and fuel poverty (12, 19). This was also linked to the fact that reducing carbon cost-effectively was mentioned in the Conservative party manifesto previously discussed in section 10.2.4 (16, 19, 20). In general however, actors believed that this was always a frame that would appeal to policy makers and politicians. In policy episode 4, company 'A' were suggesting that the RHI should be funded from general taxation because if were to be funded via bills, that could increase fuel poverty.

Despite the relative popularity of this frame, the data collected for this research hasn't shown that the use of this frame by actors has had any significant impact on the development of policy as described in the policy episodes in chapter 8. It again appears that actors have adopted this frame when it suits them, highlighting ideas of 'adoptive influence'.

10.2.8   Heat pump performance

The next most frequently mentioned frame was around the performance of heat pumps, with actors using the frame of poor heat pump performance to promote other heat (non-heat pump) options. This included actors with an interest in fossil fuels framing heat pumps as poor replacements (16, 38, 39), actors from non-heat pump renewable heat companies suggesting their technology was better (26) as well as different types of heat pump i.e. ground source versus air source framing their particular technology as better than the other (3, 10).

In policy episode 11, this frame was highlighted when one heat pump company explained that they had been telling policy makers that certain heat pumps could represent poor value for policy makers and rapidly consume the RHI budget. However, it is not apparent that this framing was successful in causing the reduction in ASHP tariffs.

Some interviewees mentioned heat pump research conducted by the Energy Saving Trust which showed that heat pumps were performing less efficiently than expected (16, 38). However, the actual 'field-trial' of heat pumps suggested that some systems were performing very well but less efficient heat pumps systems were primarily performing poorly because of poor installation rather than because of the actual technology (Energy Saving Trust, 2010).

The 'heat pump performance' frame is one that has been used fairly frequently in this research however it is not clear that its use has had any significant policy impact. The adoption of this frame by various actors suggested that this frame can be considered as 'adoptive influence'. However, the framing of heat pumps as poor solutions could be seen as 'distortive influence' with actors misrepresenting the reality of heat pumps (which are in use across the world, see Hanna and Gross, (2016)) in order to promote other technologies which they are interested in.

10.2.9   Biomass (un)sustainability

The next most referenced frame linked to the 'sustainability' characteristics of biomass combustion technologies which are supported by the RHI. In general it was recognised that some actors suggested that biomass offered limited carbon savings and therefore shouldn't be supported. Similarly to the previously described frame around heat pump performance, the biomass (un)sustainability

frame was used by potentially competing technologies including companies interested in selling liquefied petroleum gas to off-gas grid customers (11, 16) and also heat pump companies (31).

While this frame appears to have been used, clearly its impacts on policy change have been limited with the rapid growth of biomass for heat under the RHI discussed previously in section 2.4.2.2. In the most general sense, the sustainability of bio-energy can vary significantly by both type of bio-energy source and use (Committee on Climate Change, 2011) and so, sometimes biomass used for heat may be 'unsustainable'. However this is not necessarily always the case and framing all biomass based energy as unsustainable could be seen as 'distortive influence' as the reality is more complex than the frame being presented.

10.2.10   Section summary

This sub-section has considered the use of framing by actors as an approach to influence policy during the development of heat policy in the UK. It has shown that framing is a widely used approach to attempt to influence policy and the value of using framing is recognised by both those looking to influence policy and policy makers such as civil servants.

It has shown that framing varies between actors and changes over time, with frames that are seen to be valuable being linked to current issues or foci within particular Governments. For instance, the salience of a particular frame such as 'meeting the EU renewable energy target' would be less valuable for a Government which wasn't particularly interested in the EU renewable energy target (or the EU). Some frames may therefore be more powerful than others at different times and therefore from Shorten's typology of ideas (Shorten, 2013) it appears that in this research 'adoptive influence' seems to be particularly important where those looking to influence adopt a frame that suits them best at a certain point in time. This chapter has also highlighted the potential use of 'distorted influence' in particular around the framing of the performance of other technologies with actors framing heat pumps as unsuitable and biomass combustion as unsustainable.

However, other elements of Shorten's typology (Shorten, 2013) have not emerged as significant elements of framing identified in this research. Mediated

influence, where ideas are re-used by different actors have not emerged particularly strongly although, there are examples of similar actors working and using frames together. Cumulative influence (where ideas have grown, merged and developed over time to have an influence) and unconscious influence (where ideas affected political outcomes but the source of how they have arrived with particular actors is not clear) have not been recognised during the analysis of framing.

Overall, whilst framing is recognised as being a particularly widely used approach, whether or not the framing considered within this research has had any major impact on the development of heat policy is unclear. The dispersed nature of framing as an approach by actors means that measuring or attributing specific policy changes to it is complex and does not appear possible using the EAR method. It is also the case that framing may be used by actors as a part of or associated with other elements of lobbying and influencing activities.

It is clear that framing could be considered as attempting to utilise the third face of power, shaping preferences in order to achieve policy outcomes. However, I suggest that framing may also be linked to the fourth face of power as the repeated use of framing could potentially strengthen ideas and knowledge across policy actors to the point where the individuals involved in policy making then themselves reproduce those ideas and frames. This idea of the reproduction of frames and the institutionalisation of ideas likes closely to the approaches of discursive institutionalism considered in section 5.4. Building on the evidence of framing highlighted in this chapter, discursive analysis of frames and ideas in the UK heat policy process could consider the relationship between framing and post structural understandings of power in more detail.

10.3 SCALE AND SITUATION

As well as using knowledge and framing, interview data has also highlighted that for those looking to influence heat policy, the relative size and situation of actors is linked to approaches to or the ability to influence. Certain actors or types of actor may take different approaches to influence and there may be differences approaches used for different influencing targets. While this scale and situation issue may not directly relate to active attempts to have power, it

was recognised as an important element of power by interviewees and so is considered in this section.

10.3.1 Lobbying who?

Those looking to influence UK heat policy may engage with a number of different actors as a number of different actors are involved with or can affect the policy process. As described in section 5.3.1, Rommetvedt (2000) suggested that there were two main directions of lobbying, parliamentary and administrative and this research has highlighted evidence of both approaches with lobbying of Members of Parliament and civil servants.

This research has shown only two specific cases of direct parliamentary involvement in heat policy. The first example was around the development of the RHI legislation in 2008 which included an Early Day Motion and legislative amendment resulting in eventual legislative change (policy episode 2).

The second policy issue where an element of parliamentary involvement has been identified was the biomethane tariff review and development of the biomethane sustainability criteria in 2014/15 (policy episode 13). In this example, those wealthy landowners attempting to influence policy appear to have lobbied and engaged with parliamentary connections in the House of Lords who have then contacted the DECC ministers in order to then have an influence on that policy through the department.

In general, the majority of engagement and lobbying around heat policy appears to have been at an administrative level, where those looking to influence policy change have dealt primarily with civil servants and Government (policy episodes 1, 3, 7, 8, 10, 11, 12).

The various routes used to attempt to influence are shown in Figure 10-2, with each route shown as a different coloured line. In practice, lobbyists could use just one route or a combination of different routes. The purple line represents a purely political lobbying route, an example of this is the development of legislation underpinning the RHI where DECC was not initially involved (policy episode 2). The green line represents a political-administrative route where political lobbying drives a politician to make contact with a connected minister or department who then modifies policy, an example of this being the changes to the biomethane rules described in policy episode 13. The red line represents

the purely administrative route where lobbyists go straight to the Government department (either ministers or civil servants) and then a policy change is implemented. An example of this purely administrative route being attempted would be around the increase of the biomass combustion budget under the RHI (policy episode 12) where lobbyists explained that this sort of policy change was simple specifically because the decision didn't need to go through Parliament.

Key
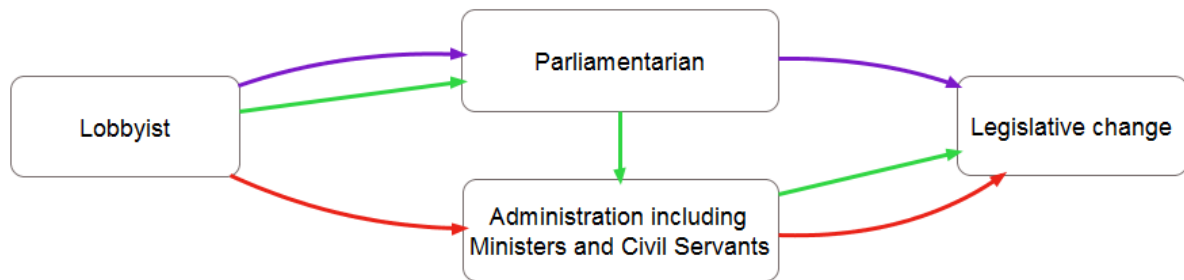
Political lobbying

Political-administrative lobbying

Administrative lobbying

Figure 10-2. Lobbying routes identified in UK heat policy

The majority of attempts at heat policy influencing have utilised the primarily administrative route, shown in red in Figure 10-2 and this is believed to be for two main reasons. Firstly, as recognised previously in this chapter, heat policy has generally stayed '*under the radar*' in political terms (23) and civil servants have been able to work with little political involvement. For example, the development of the heat strategy documents, while requiring ministerial sign off, did not need to pass through parliament before their release. And, following the acceptance of the RHI legislation into law, further amendments to the RHI legislation have not required the development of primary legislation and changes have been made through secondary legislation (which only receives limited parliamentary scrutiny (Rogers and Walters, 2004)). Of course, one exception to this was the political power of Chris Huhne who strongly supported the RHI when the coalition Government formed in 2010 (policy episode 5) however, this was not a high public profile issue and in general supported the development of the scheme.

While there appears to have been only limited political impact on the development of UK heat policy, a number of interviewees from industry and trade associations explained that they have engaged with MPs. This included local MPs or MPs with relevant interests (13, 14, 15, 16, 20, 21, 33). One interviewee explained that their firm actively monitored Hansard, the written proceedings of the UK Parliament and contacted MPs and Lords who discussed or mentioned anything relevant to the company (16). It was also explained that some lobbyists engage with the Energy and Climate Change Select Committee, the group of MPs who scrutinised the work of DECC (9, 10, 16) and this could be seen as political-administrative lobbying as select committees can question relevant Government departments.

One interviewee explained that MPs had been involved with reports around heat and this had raised awareness of heat issues (39). A report by think tank 'Carbon Connect' released in 2014 considering UK heat decarbonisation pathways which was sponsored by the Institute of Gas Engineers and Managers and gas boiler interested trade association the EUA had two MPs as 'chairs' of the analysis (Carbon Connect, 2014). It was also recognised by other interviewees that having a connection to your constituency MP also increases your connection to other MPs and policy makers (10, 38), something which could widen your engagement activities.

Overall, those looking to influence heat policy clearly recognised that their approaches needed to take consideration of who they were attempting to influence and this research has identified three key routes to influence including parliamentary, administrative lobbying and a combination of both. In the case of UK heat policy over the time period considered, the majority of efforts to influence highlighted from this research have taken a primarily administrative route. This is believed to be in light of the fact that the development of most heat policy has taken place away from Parliament and politicians. However, political lobbying has also been used as has a combination of administrative and political. For those looking to influence policy, because of the involvement of different parts of Government at different times in the policy process or with different elements of policy making, those looking to influence may be wise to ensure that the correct targets for lobbying are identified in order to increase their chances of influencing success.

10.3.2 Big versus small

In the UK energy policy discourse, there has been a recognition that larger companies such as the so-called 'big 6' have been particularly involved in the policy process and that they '*wield considerable power*' (Kuzemko, 2013c).

Overall, this research has shown that larger companies have higher levels of political capacity than smaller companies. There was a wide recognition among interviewees, from both the lobbying side and the policy making side, that larger companies had an influencing advantage because their scale meant that they had the resources and expertise to understand policy, regulation and the institutions associated with UK heat governance (4, 18, 19, 21, 23, 29, 35).

One civil servant interviewee explained that the smaller companies just '*don't understand the way you behave*' when engaging with Government (23). Another suggested that only the larger companies have the capability to look at the future strategically, i.e. taking a wider view than their own business interests (24). Another interviewee also suggested that the smaller companies simply don't have the scale to attend meetings and go to frequent workshops whereas larger companies can commit to this and mobilise appropriate resources (29). This dominance of the policy process by large actors with the capacity to engage has also been recognised elsewhere including during the development of UK energy network codes (Lockwood *et al.*, 2016).

Linked to the issues of regulatory capture and information asymmetry (considered previously in section 10.1.2), there was also a general recognition that larger companies are more able to provide evidence (18, 29) and are therefore able to use this evidence to their advantage. There was also a belief that integrated companies (large in nature) and trade associations (representing large numbers of actors with high levels of resource) were more able to provide a balanced view to Government and as such become a more legitimate source than technology specific companies (18, 22). One interviewee from EDF explained that having a sensible and technology neutral position (which they implied they had) meant that they could present a more rounded position (18). However, it was recognised within the civil service as an issue that because there are only limited numbers of actors who can provide evidence, they may provide selective evidence only (29):

> *'...they [small companies] may not even know about it (policy) or if they do, they're just not going to be able to respond, not going to be able to provide the evidence that the big companies are and I don't think there's an obvious solution.' (29)*

Conversely, there was a belief that being a smaller company could also have some benefits, one interviewee suggested that the often passionate belief in a company's own technology can be powerful and that the Government often want to be seen to help the '*little guys*' (15). Another interviewee suggested that smaller companies could be more forceful and use *'powerful and strong arguments'* which larger companies can't (18). As discussed in upcoming section 10.4, it seems to be smaller companies who have taken the most aggressive style to influencing. There was a recognition by one civil servant that the frustration and noise of small companies was understandable and could be influential because the civil servants understood the difficult position of the certain small companies who rely on policy (26).

However, other small companies explained that they had little or no involvement in heat policy development and this was generally attributed to a lack of time resource (33, 35) because within companies with a small number of staff '*there's enough day to day stuff to be doing*' (33). Another interviewee, a managing director from a biomass company agreed with the resource issue and explained: '…*I've got a business to run and at the same time I have to be a policy specialist…*' (21).

In general, it is perceived that larger companies appear better placed to engage with policy simply because they have the time and resources to commit to the policy process. While some small companies are perceived as potentially being powerful, this potential is often not utilised because the resources to utilise this power are not available. This power asymmetry could be seen to give larger companies and organisations a structural power advantage over smaller actors. Within the policy episodes in chapter 8, policy episode 10 did indeed highlight the success of the large and incumbent gas industry actors in reducing the perceived need for short term heat electrification. However, other policy successes can be attributed to smaller actors such as the origin of the RHI legislation (episode 2) and the success of the biomethane industry around tariffs and sustainability criteria (policy episode 13). Overall therefore, while large

actors are perceived as being more powerful than small actors, this perception is not confirmed by this research and while large actors may indeed have much more capacity to attempt influence, factors other than capacity are also at play.

10.3.3 Empowerment by policy

Section 9.1.2 suggested that larger actors may have a greater capacity to attempt to influence than smaller actors and it may therefore be the case that a growing market share or increasing business size should increase the political capacity of a business. As discussed in section 2.4.2.2, biomass heating has received a much higher than expected share of the RHI whereas other technologies have grown much more slowly.

A number of interviewees recognised that the voice of the biomass lobby had grown as policy had developed the industry (14, 37, 39) with one interviewee suggesting that the size of the biomass heating industry means that '*they are very muscular in what they try and do*' (39). Another interviewee suggested that the traction that biomass had gained in the market would continue for many years as the funding under the RHI lasts for 20 years for non-domestic projects (37). It was also recognised that biogas, another area which has grown substantially under the RHI, had growing influence (13).

Conversely, for the ground source heat pump industry which has seen little deployment under the RHI, one interviewee suggested that the development of policy had, rather than empower the industry, '*completely distracted us…we feel harshly treated and had we invented a biomass boiler in [redacted to maintain anonymity] 15 years ago instead of a heat pump life would be very different*' (10).

But, although the policy may not have delivered the expected number of non-biomass installations as expected, a number of interviewees believed that the existence of policy itself empowered industry. Much of this empowerment was associated with the fact that the existence of policy (the RHI), a heat strategy and a team within DECC meant that heat was on the agenda and this gave actors something to attempt to influence. This highlights the potential importance of agenda setting (the second face of power). One interviewee explained that while they did not feel that they had more influence directly, '*I think it (heat policy) gives us an in, it gives us something to go in and talk*

about…it opens the debate' (16). Another interviewee suggested that once policy exists, it is much easier to tweak something than cancel it and there is '*a presumption in favour of continuity…it is easier to influence something that is already there*' (11).

Overall, both the emergence of policy onto the agenda alongside the growth of industries supported by policy is perceived to empower actors supported by that policy. Indeed in policy episode 13, the biomethane industry which was purely created by the RHI has been powerful around some elements of policy. However, it is also the case that other technologies which were supposedly supported by the policy agenda (heat pumps) do not appear to have had any particular policy successes over the time scale considered. So, while policy can empower actors, it does not seem that this is always the case.

10.3.4   The position of trade associations

As mentioned in the previous chapter, trade associations have been heavily involved in UK heat policy development and represent many different aspects of the heat industry and varying scales. A large number of interviewees including civil servants recognised that trade associations were relatively trusted sources of knowledge and information and were often approached regarding policy issues (24, 26, 29). Trade associations were generally trusted because they represented large numbers of industry actors across the supply chain and it was felt that it was much easier to deal with one actor than many (26) and this '*shortcut*' was recognised by industry actors (12, 15).

It was suggested that technology specific trade associations were successful because they were clear in what they wanted to achieve (13, 14). Conversely it was also recognised that cross sector trade associations may have the benefit of perceived impartiality (11, 12, 13, 14). However, in reality, some interviewees believed that this perception of trade associations may be purposefully utilised. Trade associations may present themselves as impartial but are in fact representing industry interests covertly. This charge was levied specifically against the REA who, it was suggested, present themselves as generally pro-renewables but were in the opinion of one interviewee, much more supportive of biomass heat (anonymous). Interestingly, the REA explained the importance of

maintaining credibility with policy makers, describing credibility as '*our main product*' (14).

Interviewees also described that as well as making the lives of civil servants easier, the trade associations also act as a buffer for information. With a good understanding of the workings of Government, they filter out extreme information before it gets to Government and control the release of information from the Government back to the private sector (11, 13, 20). This was described as a '*deliberate…translation service*' by one interviewee (20). This interviewee (from a trade association) has previously been described as being '*very much inside the tent*' by a DECC civil servant and it was recognised by civil servants that trade associations were trusted with information that wouldn't be given directly to industry (26). It was indeed that case as highlighted in section 9.1.3.3 that Government had shared draft regulations with trade associations (The REA and SEA) and did not appear to have shared them with anyone else. While these close relationships which trade associations want to maintain may be good for them and their respective members, one interviewee suggested that this buffer role of trade associations meant that DECC did not talk to industry directly and as such received a '*sanitised view*' of industry (17). It was also suggested by an interviewee who had worked across industry and Government that because the trade association views were so watered down and communication was so managed, the potential for radical proposals for policy was limited because the trade associations were so closely aligned with the Government's way of thinking (15).

Trade associations have been very closely involved in the development of UK heat policy and have been involved and apparently successful in their work around the development of the RHI legislation (policy episode 2). Trade associations have also been involved in the design of the RHI (policy episode 3), the increasing drive for heat decarbonisation (policy episode 8), the distribution of RHI funds (episode 12) and the changes for biomethane (episode 13). Overall, trade association are sometimes, but not always, successful in having power to affect the development of policy in this study.

Clearly, trade associations have an important role in the UK heat policy network and appear to be relatively trusted sources of information for policy makers. However, their actual policy impact appears limited. Despite being apparently

trusted by policy makers, trade associations have their own interests, primarily representing their membership. Trade associations are therefore in reality not necessarily objective sources of information and will often be representing interests. Although cross sector trade associations may balance the views of members, the apparent trust in trade associations by Government puts the associations in a potentially powerful and privileged position which they may not deserve.

10.3.5   Working together or battling

A number of interviewees recognised the benefits of working together with other organisations in order to develop joint messages, believing this has a greater influence over policy rather than if they were working as a single entity. The interview data suggested that a number of different coalitions existed and these could either be informal such as trade associations working together or much more formal such as trade associations themselves. As described in the previous section, some trade associations recognised a benefit in the fact that they represented a number of technologies and could provide a wider view than single companies (9, 11, 12).

In the policy episodes considered, organisations including trade associations and NGOs came together to lobby for the introduction of the RHI (policy episode 2), companies worked together to push the heat strategy vision to a less electric future (episode 10) and the biomethane industry also worked together to lobby for maintained RHI tariffs and reduced sustainability standards for biomethane (episode 13). In all of these policy episodes actors appear to have had some success in causing policy change suggesting that working together has been successful in these examples.

While working together through coalitions may create better outcomes in terms of policy change, the interviewee data also shows that working together did not always happen. There is evidence of infighting across the sustainable heat actors (7). This includes, as described in section 10.3.5, ground source heat pumps lobbying against air source heat pumps (10, 16), the heat pump industry lobbying against the biomass industry (19, 34) and biomass against heat pumps (21, 31). This infighting was recognised by those representing the niche renewable heat industry (7) with one explaining '*I've been at meetings and*

heard people completely disagree on pretty fundamental issues and you're sort of thinking crikey, if we as an industry can't agree, where the blinking hell do the policy makers start?' (31).

It was recognised by industry that the civil servants saw this as an issue (31) and a number of civil servants mentioned this infighting during interviews (23, 26, 29). One civil servant explained that the fighting had become '*counter-productive*' to the policy making process (23) while another was more candid:

> *'the other thing that I think was a problem on the RHI was the infighting between all the, so they'd just slag each other off and I'd often sit in meetings or have workshops and I'd say look, you will all get tarred with the same brush, if you go out and say biomass is shit and you go out and say heat pumps are shit, the noise will be renewable heat is crap so don't do that...most people don't know what a heat pump is and you're going out there slagging off the other technology, it won't help you overall' (29)*

Policy success has been achieved in some examples in this research where organisations have worked together, suggesting that working together may be able to increase the power of actors over policy change. The idea of working together links back to the idea of intransitive power which was considered in chapter 4 which suggests that by coordinating and working together, actors can increase their power and achieve goals.

10.4 STYLE

Whilst it was possible to assign most approaches to influence to one of three previous sections, style also emerged as an approach to influence which didn't sit clearly within one of the previous sections. Interviewees suggested that actors used different styles in their approaches to attempt to influence heat policy and these varying styles are considered in this section.

A large number of interviewees recognised the use of aggressive approaches by some of those looking to influence policy (14, 15, 23, 26, 28, 29, 31); these comments were associated with extreme views, attempts to damage reputations of technologies and even personal threats. The majority of these comments link to previous discussions in this thesis regarding company 'A' and

company 'B' (sections 9.1.2.1 and 9.1.3.4 respectively) and therefore, the details around these companies are not explored in detail. It was explained by one civil servant that the '*level of aggression from some of the stakeholders was quite frightening*' and the ultimate conclusion of this approach was that '*Greg Barker doesn't want to take your phone calls anymore, the officials don't want to meet you anymore and invariably it doesn't do your cause any good*' (23). This civil servant also explained that another actor, '*who represented one of the biomass fuel manufacturers would just suddenly fly off the handle in a rage about how bad heat pumps were*' going on to explain that '*we* [civil servants] *all found that rather puzzling, that here we are in DECC trying to give your industry billions of pounds of tax payers money and all you can do is complain about it*' (23).

Other civil servants recognised this aggression among those attempting to influence, suggesting that these approaches undermined people's own positions (28). However, some civil servants suggested that in general people were negative about policy (24), that aggressive voices could still have an important point (29) and Government could sometimes understand where they were coming from i.e. why they were so negative (26) (this could for example because policy has failed to support certain technologies when it was expected to). From the policy episodes considered, it is not clear that the use of negative or aggressive approaches has directly driven any of the policy changes identified and it is therefore not possible to say that any actors using these approaches have had any policy successes.

It was noted by a number of interviewees that using a positive style when conveying messages was likely to be more influential than more negative approaches (14, 16, 20) and a number of civil servants believed that positive messages which help provide solutions were much more useful (23, 29). As explored in section 9.1.3, the REA and the SEA, trade associations which represented lower carbon heat actors (rather than incumbents and gas interests) were recognised as having a particularly positive approach to influencing. Both the REA and SEA were associated with significant elements of a number of policy episodes in chapter 8 and appear to have had a close working relationship with Government. Policy episode 2 highlights that the REA

have also had some influencing success in driving the RHI legislation although this episode didn't necessarily highlight a 'positive' approach.

A number of interviewees also believed that an approach which worked with Government, by using Government's own approaches and using balanced and objective arguments would be particularly beneficial (14, 16, 19, 20, 31, 32). It was also recognised that the use of balanced approaches was also important for people to maintain credibility with policy makers (14, 18). This use of balanced arguments is possibly linked to the importance of perceived objectivity by policy makers which has already been considered in section 10.1.2.1.

It appears that only a very small volume of literature has considered lobbying style in any detail. Some previous research has considered the differences in lobbying styles between the USA and Europe and this research showed that in the USA, approaches to lobbying were brash and highly pressured whereas in Europe, lobbying approaches tended to be more softly spoken, consensus based and informational in Europe; this was put down primarily to the different political styles between the EU and the USA (Woll, 2012). This research has highlighted the both brash and more softly spoken attempts to lobbying associated with UK heat policy.

While the research has shown that actors did use different styles in their approaches to influence, the data does not show that the use of particular styles for attempting to influence is likely to increase policy change success. With regards to theoretical approaches to power, style could be potentially seen as linked to the third face of power with actors shaping their approach to communication in order to attempt to affect the preferences of policy makers in order to engender policy change. It is not clear how style as an approach could link to the other faces of power.

10.5 CHAPTER CONCLUSIONS

Building on the previous two results and discussion chapters which have considered the policy episodes and also the actors involved in attempts to influence UK heat policy, this chapter has considered the approaches used by different actors to attempt to influence policy. It has linked the approaches identified back to the previous two chapters as well as the theoretical understandings of power introduced earlier in this thesis.

The interviews identified three key elements of approaches to attempt to have power over the policy process. The first element was around knowledge and the use of evidence and within this element, the use of consultations, information asymmetries and the role of consultants and energy models appeared as key themes.

Knowledge has been absolutely central to the development of UK heat policy and knowledge has been an important element of many of the policy episodes around for example setting RHI tariffs and influencing the development of the Government's strategy for heat. Knowledge is centrally important to the UK's policy process as civil servants who are involved in all policy decisions are required to make evidence based decisions. This implies that those with knowledge which is in demand can indeed have power and the production of and interests behind the production of knowledge can be extremely important.

The analysis suggested that knowledge could be associated with all four faces of power but in particular, in the approaches identified, knowledge was used to attempt to give certain actors power over other actors (first face), to allow actors to try to set agendas (second face) and could be used by actors to attempt to shape preferences (third face). The embedding and reproduction of knowledge and evidence also could be seen to be linked to the fourth face of power. Overall, it appears that knowledge and power are closely related in this study, an idea recognised in the theoretical underpinning section of this thesis (Gordon, 1980).

The second key element of approaches to influence was around the use of framing by actors looking to influence UK heat policy. There was a clear recognition by both policy makers and those looking to influence that framing was a very important approach and the detailed section on framing considered many of the specific frames used in more detail. Generally, the use of framing can be considered as an approach linked to the third face of power, whereby those looking to influence use framing to attempt to shape the preferences of policy makers so that proposed policy changes are aligned with the interests of the policy makers. However, it is also the case that in using frames which link to the existing beliefs of policy makers or indeed linking frames to institutionalised ideas such as targets for renewable energy, the use of framing is also linked to the fourth face of power. Framing was an approach to influence that appeared

to be used alongside or as part of other approaches to influence. While framing on its own was not seen to have caused any specific policy changes, it was seen as one of a set of influencing measures which could be used together with other approaches showing that attempts to influence may use combinations of various approaches.

The third key area of 'approaches to influence' recognised from the interviews was linked to the scale and situation of actors. Larger actors may have more capacity to attempt to influence and trade associations which can represent entire sectors can also capitalise on their scale, this issue highlighted a structural element of power where power can be linked to scale. However, small actors involved with technologies which Government was looking to support were sometimes seen as being powerful if the Government wanted to grow those particular technologies (i.e. the technologies of interest were already on the agenda). Companies or actors working together was also seen as an approach which could increase policy success linking to ideas of intransitive power.

This chapter also highlighted that actors used varying styles in their approaches to influence, ranging from aggressive approaches to more balanced approaches. Style could be seen as being linked to the third face of power, as an attempt to shape preferences of policy makers although style could of course simply be a reflection of the personalities of the interested companies and individuals. Overall, this chapter has provided an interesting example of the approaches used by actors to attempt to influence policy during the process of system transformation. As well as providing examples of the approaches used, it has also linked these approaches back to the theoretical understandings of power suggesting that connections with all four faces of power are present in the approaches identified.

11 NETHERLANDS CASE STUDY – POWER AND LOBBYING IN DUTCH HEAT POLICY

Rotterdam Sunset, September 2015.

'*Well I am not fond of politicians, there are places where the law has made a mistake but you are stuck with it and with ours at least they are not that worse as Putin*'

(anonymous interviewee)

11.1 INTRODUCTION

This case study considers Dutch heat policy and the role that power has had on the development of the policy and regulation for low-carbon and sustainable heat between the years 2007-2015. The Netherlands was chosen as a case study because of its similarity to the UK in terms of both the current provision of heat which is mostly supplied by gas and also because the country faces similar challenges to the UK - depleting gas resources and goals for decarbonisation. It

was expected that there may be similar power struggles and issues in Dutch and UK heat policy and therefore the focus of this chapter is on considering power in Dutch heat policy and how this compares to UK heat policy. As with the UK study, it has used a number of interviews with those involved in the Dutch heat policy network alongside a review of relevant grey literature.

The scale of the Dutch case study in terms of data collection is smaller than the UK study. This reflects the fact that the UK was the primary focus of the research and was also due to the more complex nature of identifying and analysing relevant data and interviewees. Some Dutch interviewees spoke only limited English and much of the grey literature was not available in English and required translation. Despite the smaller scale, the Dutch case study does provide a valuable comparison to the UK study.

Following the structure of the UK sections of this thesis, this chapter firstly considers the Dutch heat regime describing the current provision of heat and then considers how and why the Dutch heat system may need to change (section 11.2). The chapter then considers early efforts and ideas around transforming the heat system in the Netherlands as well as more recent developments in the Netherlands with regards to gas and heat.

The chapter then goes on to consider what interviewees have identified as the key heat policy changes and developments in the Netherlands and using the EAR approach, investigates if actors have had any power in affecting Dutch heat policy change (section 11.3). Following this, section 11.4 considers the approaches identified which have been used to attempt to influence Dutch heat policy. Unlike the UK case study, this chapter does not contain a specific section on 'actors' as this is a smaller scale study than the UK case; comments regarding particular actors are included in the sections on policy change and approaches to influence. As well as comparing findings from The Netherlands to those from the UK, ideas in this chapter are also considered in relation to the theoretical understandings of power introduced in earlier sections of this thesis. As with the UK results, all information gained from interviews is referenced as a number in round brackets and interviewees are listed in annex 2. Interviews were carried out in person in September 2015 or over the phone during the winter of 2015/16.

11.2 HEATING IN THE NETHERLANDS

In 2012, heat made up around 55% of the Netherland's total energy consumption (Ministry of Economic Affairs, 2015b). The role of gas in the Dutch domestic heating regime has such a high penetration that even almost two decades ago gas for heat has been described as '*approaching (if not having actually reached) saturation*' (Griffin, 2000, p3). Of the 8 million households in The Netherlands (CBS, 2018c), 93% of homes are connected to the Dutch gas network and use gas for heating; the majority of remaining homes (4.5%) are connected to district heating networks (ECN *et al.*, 2016). In the service sector, gas also dominates (approximately 70% of heat consumption) although like in the UK, electricity makes up a slightly bigger share in this sector (around 20%); space heating in industry is provided primarily by gas (Heat Roadmap Europe, 2017).

The high level of natural gas for heat in the Netherlands is often attributed to access to indigenous supplies of natural gas and a high population density, allowing the development of a low cost per household gas network using indigenous resources (Griffin, 2000). It should be noted however, that before natural gas became dominant in heating, the Netherlands was using town gas which, via a gas distribution network, was already supplying 76% of households in 1962 (Oxford ECI, 1999).

With 501 people per square kilometre of land, the high population density of the Netherlands is almost double that of the UK overall (World Bank, 2014). However, in England, where the penetration of gas is higher than other parts of the UK, the population density is 423 people per square kilometre of land showing a similar population density to The Netherlands (ONS, 2014). High population densities and access to indigenous sources in both the UK and the Netherlands may explain why gas use for heat is so prolific in both countries.

The direct use of electricity, oil and solid fuels for domestic heating in the Netherlands is very limited (Menkveld and Beurskens, 2009) reflecting the high penetration of gas and the fact that the remainder of households are generally served by district heating. While the high gas penetration in the Netherlands shows a similar pattern to most of England where the UK gas network is at almost full saturation point, in areas of the UK not on the gas grid, there are a

number of properties which use oil or electric heating representing around a fifth of total space heating demand (DECC, 2013c).

11.2.1 Netherlands gas supply

In 2009, The Netherlands overtook the UK (whose gas production was declining) and became the largest producer of natural gas in Europe; in 2016 the Netherlands produced around 443 terawatt hours of natural gas in 2016 compared to the UK's 416 terawatt hours[41] (Eurostat, 2018b). The country has historically been and was expected to continue to be a net exporter of gas at least in the short term however, over the longer term (decades), gas production in the Netherlands was expected to reduce as gas resources depleted (IEA, 2012).

Much of the Netherland's gas has been produced from the Groningen gas field which has provided around half of all the Dutch gas production for the past two decades (Mulder and Perey, 2018). In 2013, the Groningen field produced 54 billion cubic meters of natural gas, the highest level in over 30 years (Ministry of Economic Affairs, 2017a). However, the extraction of gas from the Groningen field has resulted in an increasing intensity and frequency of earthquakes in the area as gas extraction has caused the overlying land to shift and sink (TNO, 2016). As a result of the earthquakes and the resulting damage to buildings, the gas supply outlook for the Netherlands has changed dramatically.

The Dutch Government announced in January 2014 that in order to reduce the risk of further earthquakes it would reduce the allowed annual gas output for Groningen for 2014, 2015 and 2016 to 42.5, 42.5 and 40 billion cubic meters respectively (Ministry of Economic Affairs, 2014). However, in 2015, the Government announced that the annual output for Groningen would be reduced further so that for 2015/2016 allowed production would be 27 billion cubic meters of gas (Ministry of Economic Affairs, 2015a). In 2016, this limit was reduced again to 24 billion cubic meters of gas per year for a maximum of four years (Ministry of Economic Affairs, 2017b). More recently, the Dutch Government has announced that gas production from the Groningen field may be reduced to below 12 billion cubic meters per annum before 2020 (Ministry of

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[41] Converted to terawatt hours from tonnes of oil equivalent using the IEA unit convertor (https://www.iea.org/statistics/resources/unitconverter/)

Economic Affairs and Climate Policy, 2018a). These reduced outputs from the Groningen field clearly represent a major change to gas supply in the Netherlands from only five years ago.

Figure 11-1 and Figure 11-2 display expected gas production for both Groningen (based on current Government limits) and other gas fields respectively and show that as well as seeing a rapid reduction in output from Groningen, other Dutch gas fields are expected to be nearly depleted by the mid-2040s. As a result of reduced gas production, the Netherlands became a net importer of gas for the first time in 2017 (CBS, 2018a). Unless demand is reduced (or production is increased), the further expected reductions in gas output will increase Dutch gas import dependency further.
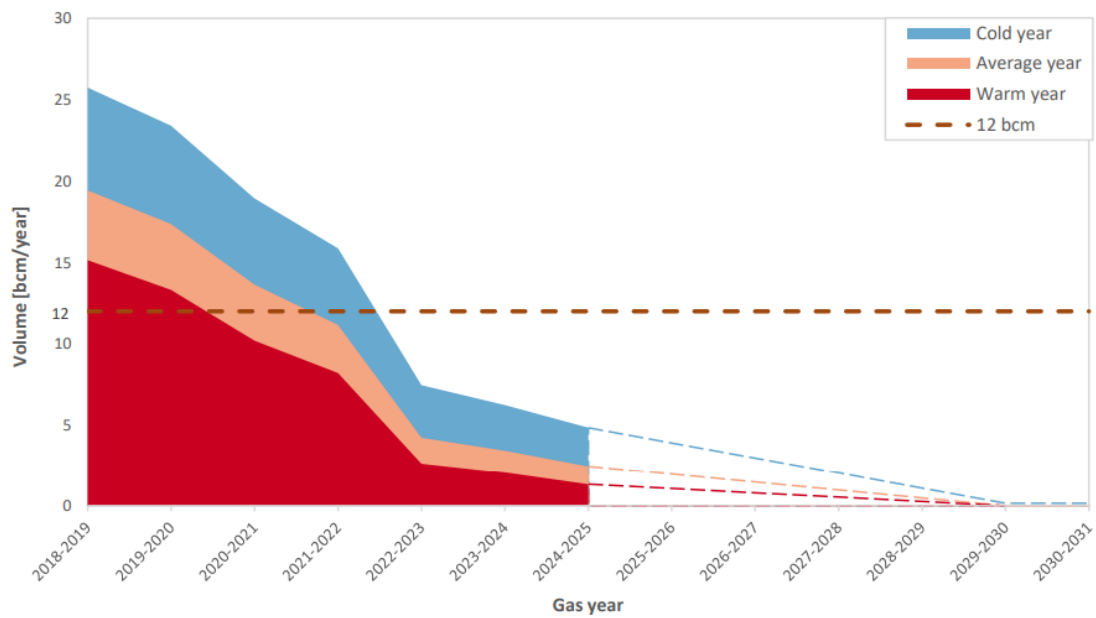

Figure 11-1. Expected gas production from Groningen field taking into account Government limits (Ministry of Economic Affairs and Climate Policy, 2017, p21)
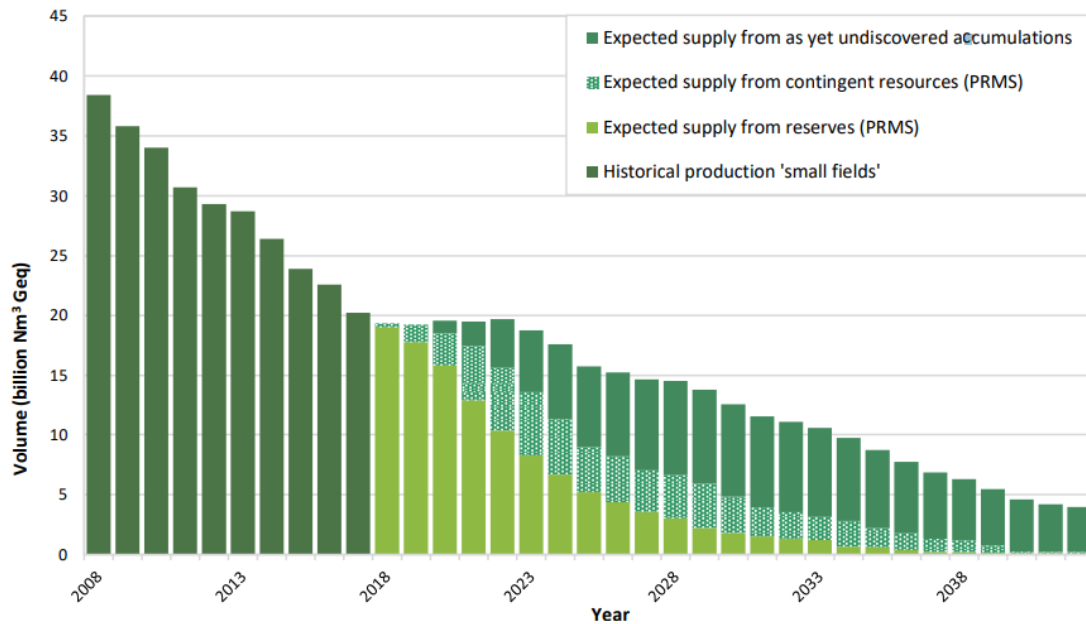
Figure 11-2. Expected gas production from small fields (not Groningen) (Ministry of Economic Affairs and Climate Policy, 2017, p22)

The Dutch Government has suggested that in order to reduce the country's reliance on indigenous gas, it will look to increase gas imports and that in the longer term, the reliance on natural gas for heating will be reduced: *'In the future, Dutch households and businesses will rely less on gas for heating and more on sustainable heating solutions. Energy conservation measures will also reduce demand for gas*' (Ministry of Economic Affairs, 2015a).

11.2.2   Transforming the Dutch heat regime and the 'Heat Vision'

Following the 2014 announcement on reducing gas output from Groningen, in April 2015, the Dutch Ministry of Economic Affairs which is responsible for energy policy issued a letter to the Dutch Parliament outlining its 'Heat Vision' (Ministry of Economic Affairs, 2015b). This document built on the Dutch ambition to have a '*wholly sustainable energy supply system by 2050*' which had been previously outlined in the 2013 'Energy Agreement' (Netherlands Ministry of Economic Affairs, 2013, p3). Specifically the 'Energy Agreement' introduced targets for reductions in Dutch energy demand, an increase in the proportion of renewable energy used (a minimum of 16% of all energy by 2023) and an increase in the number of energy related jobs. The 'Energy Agreement' did not however contain a specific carbon reduction target or explain what it meant by 'sustainable'. The 2015 'Heat Vision' suggested that transforming the

heat system would be a crucial aspect of meeting the 'Energy Agreement' goals.

The 'Heat Vision' paper also discussed the issues with gas production in Groningen and suggested that significant reductions in heating demand, increases in the use of heat networks and the roll-out of renewable heat were central to this vision; it also suggested that the gas network would be replaced in many areas by other forms of heat including district heat networks and electric heating options (Ministry of Economic Affairs, 2015b).

Although the 'Heat Vision' was recognised as being an important step, it was suggested by one interviewee that it was a small step because it didn't contain firm commitments and was believed to have been watered down: '*at a certain point we said if you dilute it even further you can use it for the washing machine industry. It was so non-specific and so did it help us, let's say it was another step in the right direction*' (49).

The development of the 'Heat Vision' represents a similar step to the development of 'heat strategy' in the UK which took place around 2012 and 2013. The 'heat vision' also suggested similar options for the decarbonisation of heat including a replacement of much of the heating currently provided by gas with increasing levels of electric heat and heat networks; like the UK's heat strategy, the Dutch 'Heat Vision' also didn't propose any specific policies or targets.

11.2.3   The 'Energy Report'

The Dutch Government had been working towards a wider sustainable energy strategy beyond heat and in January 2016, the Dutch Government released: 'Energy Report - Transition to sustainability' which described the Government's plan to reduce greenhouse gas emissions by 80-95% by 2050 and to reduce its dependence on energy imports (Ministry of Economic Affairs, 2016). Within this document, the Dutch Government proposed transformative changes to the Dutch energy system and for heat explained that:

- The heat system would need to emit (almost) no carbon emissions by 2050;
- Natural gas use in heating should be reduced as much as possible;

- Reducing energy demand of new and some existing buildings to very low energy levels would need to take place;
- A rapid growth in renewable heating sources (including solar thermal, heat pumps and biogas) and district heat would need to take place;
- Local and regional governments will be required to develop low carbon heat plans but the national Government will provide support and a 'framework'.

The report went on to suggest that the gas network may need to be replaced in some areas with district heating but suggested that it was '*an excellent time to explore options for different, sustainable heat supplies*' due to the fact that many parts of the gas network would soon require replacement (Ministry of Economic Affairs, 2016). This marks an interesting comparison to the UK where for the current price control period (RIIO GD1) which runs from 2013 to 2021, an average of 3,200 km of gas main is being replaced each year. How the mains replacement scheme should continue beyond 2021 is yet to be decided although regulator Ofgem currently appear minded to maintain much of the programme in the period from 2021 to 2026 as there are safety concerns around not replacing certain pipes (Ofgem, 2018d).

The Dutch 'Energy Report' was released after the research interviews for this thesis had been carried out and while providing useful context for the Dutch approach to heat is not directly relevant for questions of power considered in this research.

11.2.4 Support for renewable heat and heat networks

As well as having the long-term goal for a 'sustainable' energy system, the Netherlands has a renewable energy target of 14% by 2020 under the EU Renewable Energy Directive (European Union, 2009), comparable to the UK's 15% target.

The capacity of renewable energy in the Netherlands has grown although it is suggested that at current rates, the Netherlands is not likely to meet its 2020 renewable energy target (AURES, 2016). Figure 11-3 shows how the capacity of renewable energy has grown in the Netherlands and it is clear that in order to reach the 2020 target, a much faster level of growth in renewable energy

production will need to be achieved and the 2020 target looks unlikely to be met.
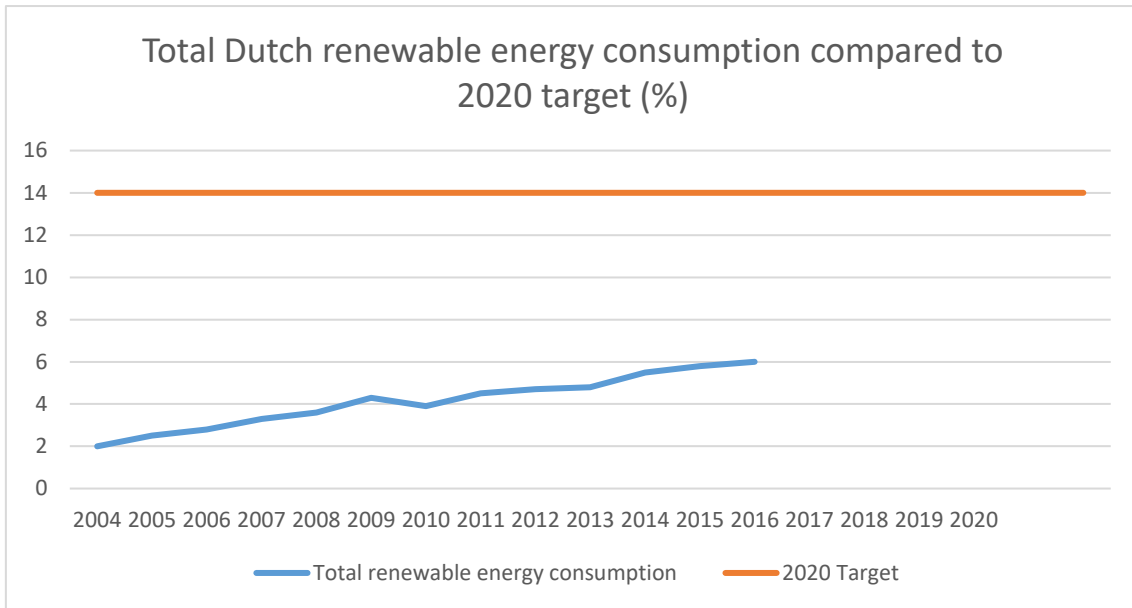
Figure 11-3. Share of renewable energy in the Dutch final energy consumption compared to 2020 target. Data from Eurostat (2016)

Dutch energy statistics show that in 2017, renewable heat was responsible for just over half of Dutch renewable energy consumption. Around 10% of total Dutch heat for 2017 came from renewable sources and the split of renewable heat production by technology is shown in Figure 11-4 (CBS, 2018b). Biomass is by far the largest constituent of Dutch renewable heat production and data from 2014 shows that the majority of biomass used for heat was used in homes (most likely in stoves and fires) (Netherlands Enterprise Agency, 2015b).
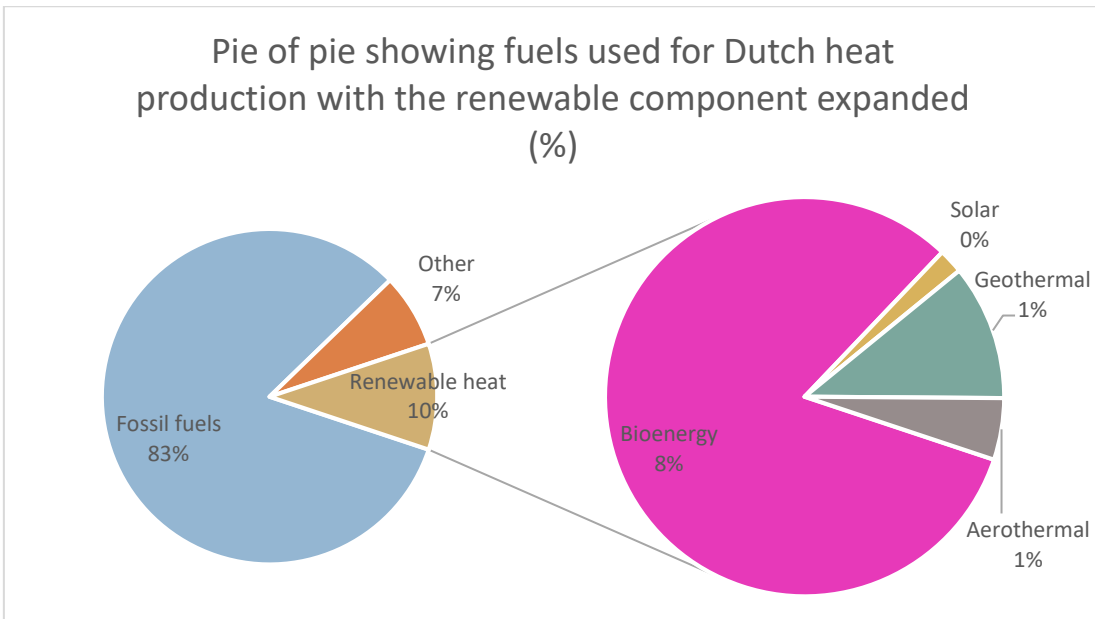
Figure 11-4. Heat production in the Netherlands for 2017 split by technology with the renewable component expanded. Geothermal includes ground source heat pumps, aerothermal is air source heat pumps, bioenergy includes biogas. Other includes heat primarily provided by district heating. Data synthesised from CBS, (2018c) and CBS, (2018b)

The Dutch Government has supported renewable energy for a number of years through various schemes and since 2008 the 'SDE' (Stimulation of Sustainable Energy Production) policy has been the main mechanism which supports renewable energy. From 2008 the scheme supported renewable electricity and biogas for electricity or grid injection (Hahn *et al.*, 2010). In 2012, the scheme became the 'SDE+' and it now supports a variety of renewable heat sources including geothermal, solar thermal and biomass heat (AURES, 2016). The scheme is a competitive auction process designed to reward the lowest cost renewable energy projects and if successful, projects receive a guaranteed income (relative to wholesale energy prices) for a number of years dependent on the type of renewable energy technology (AURES, 2016).

The most recent data regarding total capacity delivered by the SDE scheme which shows the total cumulative capacity delivered is show below in Figure 11-5 and this does indeed show growth in all technologies. However, determining how renewable heat capacity in the Netherland's has changed as a result of the SDE+ scheme is not an easy task because the data from the scheme is not currently broken down into heat and electricity.
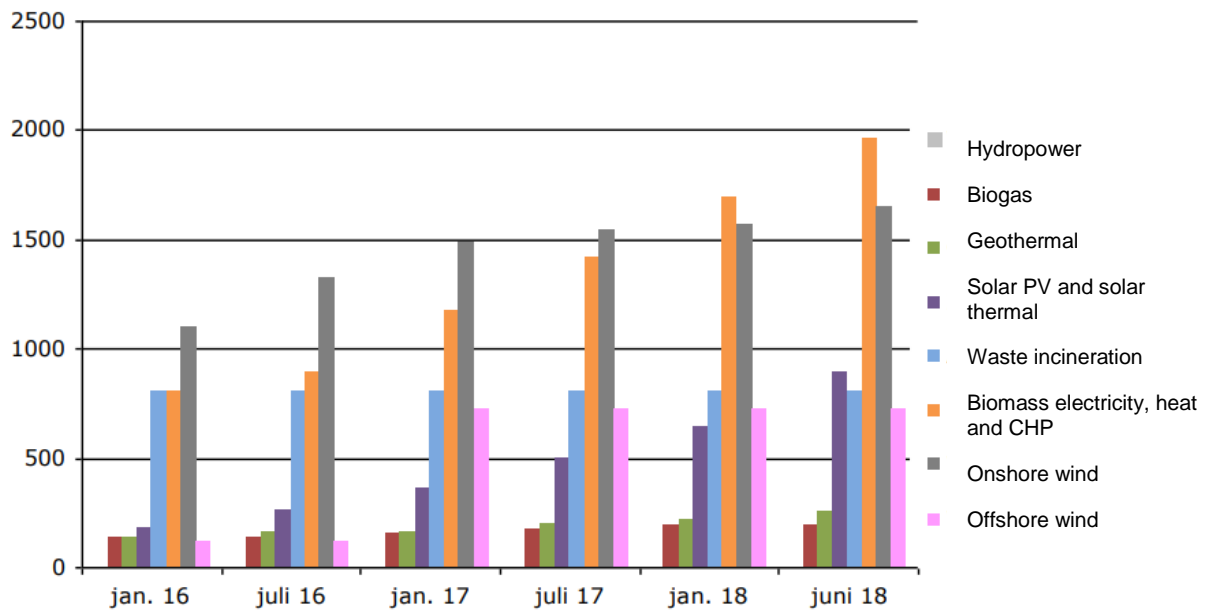
Figure 11-5 Capacity realised under the SDE (+) scheme (MW) (Netherlands Enterprise Agency, 2018a)

Figures from the 2015 Netherlands 'Renewable Energy Report' which did break down data from the SDE into heat and electricity (this report appears to have been replaced by CBS statistics which now do not break down projects into electricity and heat) show that the majority of renewable heat capacity delivered by the scheme has been from biomass using boilers or combined heat and power (Netherlands Enterprise Agency, 2015a). According to the 2015 report, the SDE+ had delivered heat capacity of:

- 1 MW of solar thermal has been installed;
- 128 MW of biogas has been built;
- 849 MW of biomass heat/CHP has been built;
- 140MW of geothermal heat has been built (Netherlands Enterprise Agency, 2015a).

The capacity of renewable energy in the Netherlands is growing and this growth is supported by the SDE policy however, it appears unlikely the target for 14% of energy to come from renewable energy sources will be met. One specific and significant failing of the SDE policy has been the number of projects which have withdrawn after being allocated subsidy highlighting an issue with reverse auctions often known as 'the winners curse' (Woodman and Fitch-Roy, 2016). Around half of the projects which won auctions in 2012, 2013 and 2014 withdrew and as a result that budget went unspent; much of the capacity which withdrew was geothermal projects (Netherlands Enterprise Agency, 2018a).

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A scheme for small scale low-carbon heat technologies, similar to the GB domestic Renewable Heat Incentive, (The Investment Subsidy for Sustainable Energy (ISDE)) was only introduced in 2017 which supports heat pumps, solar thermal and biomass (Netherlands Enterprise Agency, 2017). Early Government data shows that the ISDE scheme has been primarily supporting the deployment of heat pumps and that for 2018, there have been around 24,000 applications which equates to around 75% of the budget (Netherlands Enterprise Agency, 2018b).

As well as attempting to support renewable heat, the Netherlands has also introduced price regulation for district heating networks, through 'The Heat Act'. This came into force on the 1st January 2014 with the main aim of protecting consumers for paying too much for heat and ensuring they are generally protected (Warmetewet, 2014). The introduction of this legislation was led by the Dutch Parliament (rather than Government) and is considered in more detail in section 11.3.3. There has been concern that this regulation has not been appropriate and the Heat Act has since been reviewed. The review explained that the central 'not more than otherwise principle' where a heat consumer should pay no more than an equivalent gas user has been very difficult to regulate because of the complexity in comparing gas prices to district heating prices (Ecorys, 2016). This review also suggested that in relation to the required changes to the heat system:

- The current heat market does not provide an attractive investment proposition because of the relative costs of the alternative (primarily gas);
- There is limited public support for heat networks;
- Heat networks are not generally considered by local developers and planners because other options are cheaper;
- The incentives to both produce and supply sustainable heat into heat networks do not support renewable heat and so gas is often used to produce heat.

(Ecorys, 2016)

Building on the review of the Heat Act and as described in section 11.3.3, the Government has since amended the legislation. However, as explored in the upcoming section, the amended legislation is not yet fully in force.

11.2.5　Section overview

The heat policy context of the Netherlands shows many similarities to the UK. Firstly, both countries are similar in terms of the current situation, both countries have significant gas grids with a high proportion of households connected and using gas for heat. Expectations of a system transformation to a future heat system which has lower levels of energy demand, and a higher proportion of heat coming from renewable sources and via district heat network are also similar for both countries. It should however be noted that the UK is currently investigating the option of converting the gas grid to run on hydrogen produced from fossil gas whereas there appears to be a focus in the Netherlands of removing gas from the system. Finally, early delivery of renewable heat under renewable energy incentives in both countries (the SDE+ in the Netherlands and the RHI in GB) has led to significant growth in biomass combustion in both countries although the ISDE scheme appears to be delivering some non-biomass systems (primarily heat pumps) at the smaller scale. The policy mechanisms to achieve this deployment of low carbon heat in the Netherlands (auctions and grants) are however very different to those in the UK where tariff based mechanisms have been used.

11.3 HEAT POLICY CHANGE IN THE NETHERLANDS

The following sections consider the development of heat policy in the Netherlands investigating where actors have tried to influence policy, who these actors are and if there has been any policy influencing success or power. The inclusion of specific episodes has emerged from interview data and the episodes also draw on grey literature in order to support attempts at data triangulation.

In general the data has highlighted that there have been some significant heat policy developments in the Netherlands. There was a recognition that the Government had begun to work across departments on heat issues and the Ministry of the Interior (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties), The Ministry for Infrastructure and the Environment (Ministerie van Infrastructuur en Milieu) and the Ministry of Economic Affairs (Ministerie van Economische Zaken) worked together on the energy transition plans (41). According to one representative from the Rotterdam Government:

'*I'm very happy with what you see and that was also nice with both the 'Energy Agreement' and the 'Heat Vision' is that both departments have found each other and realised that it's the combination of things that make it work, that's a big benefit but we still have a long way to go*' (41). The 'Heat Vision' document does indeed explain that the Ministry of Economic Affairs has worked with the Ministry for Infrastructure and the Environment (Ministry of Economic Affairs, 2015b) suggesting that departments have been working together on heat issues indicating interest in heat across Government.

There was also a general recognition that the Dutch Government was seriously considering transformative change with according to one interviewee, a Dutch Government official publicly saying at a conference: '*what I would really like to write down in our plan is that we will stop in 2035, in 20 years' time, stop heating houses with natural gas, we will just stop, we won't do it anymore*' (50). At the time of interview it was however recognised that this position did not yet represent official Government policy (50). However, with the release of the 'Energy Report' in 2016, major changes to the Dutch heat system including the total decarbonisation of heat and the general removal of gas by 2050 do appear to have Government support.

Overall, there was a recognition from interviewees that the Government is supportive of major changes to the Dutch heat system and this support for change has grown. The following sections explore the power associated with more specific Dutch heat policy issues which have been highlighted by interviews.

11.3.1 Dutch policy episode 1 - The inclusion of renewable heat in the SDE/SDE+

As the key measure to promote renewable heat sources with financial support, the SDE+ policy represents an important area where actors could attempt to influence Dutch heat policy. The first major change to the scheme of relevance to heat was the inclusion of renewable heat within the scheme in 2012 when it became 'SDE+' (from 'SDE').

One interviewee suggested that the geothermal and glasshouse food production industry were the loudest lobby supporting the inclusion of heat into the scheme as geothermal was seen as being a good technology to replace gas

in the glasshouse industry (45). While the interviewee (not from the glasshouse or geothermal industry) explained that lobbying had taken place, the interviewee, did not believe that this lobbying caused the policy change as the ministry had existing plans to broaden the scheme anyway (45). Separately, there was a suggestion from a representative of the heat pump industry that the heat pump industry had been involved in a long lobbying process to support the inclusion of heat in the SDE+ (49).

When asked about the lobbying impact of industry on the SDE, a civil servant who worked the development of SDE scheme explained that while there had been some lobbying from industry, this had not been the cause of the inclusion of heat in the scheme: '*often there is a lot of pressure from lobby groups and we have to change things because of them...in this case the pressure was not that big*' (46).

In this example of policy change, while it appears that the industry has attempted to influence the SDE policy to include heat and the policy eventually did support heat, the view of a policy maker and one industrial lobbyist does not actually suggest that the industry had any power over that particular policy change. In order to triangulate this policy change further, a review of grey literature was carried out which provided only limited results. A report by Dutch public research institute ECN (Energy Research Centre of the Netherlands who advise on energy issues including SDE tariffs) explains that the Dutch Government had asked ECN to provide analysis and advice on whether and how to include heat in the SDE scheme but did not show that any sort of industrial lobbying had caused this request to be made (ECN, 2011). The Dutch Government's 2011 'Energy Report' did mention changes to the SDE including the inclusion of heat, but did not explain the reasons for its inclusion thereby providing no further information on the change (Ministry of Economic Affairs, 2011).

According to an interviewee from ECN, ECN were actually involved even earlier than the 2011 analysis and had produced renewable heat cost data for the Dutch Government in 2009/2010 (51), however, the grey literature review did not discover this earlier analysis on heat.

Overall, while the inclusion of heat within the SDE scheme is a significant policy change, this analysis which has been able to use 'thorough' triangulation hasn't shown that any specific actors have caused this policy change, despite apparent attempts to lobby the Dutch Government on this issue. It does appear however that the Dutch Government and its advisor ECN were discussing the inclusion of renewable heat in advance of eventual policy changes. As with the UK policy episodes, this episode highlights the limits of so-called 'preference attainment' methods for considering the impact of actors on policy as, under this method, this episode would have provided a positive result which has not been confirmed by more detailed analysis.

In the UK at the time of introduction of the RHI, industry pressure for support for renewable heat was large, particularly from renewable energy trade associations and unlike in the Netherlands, the industry was seen to be successful in encouraging the introduction of the RHI in the UK (see policy episode 2, section 8.2). However, it is worth bearing in mind that in the UK it is also known that the Government was planning to introduce support for renewable heat and the industry pressure may have simply sped up the process. One key difference in the policy process uncovered in this section is the role of ECN in engaging with and advising the Government on technical energy issues; the UK does not have an equivalent independent and official energy research and advisory body (although the Committee on Climate Change does advise on carbon budgets and decarbonisation).

11.3.2   Dutch policy episode 2 - Influence over SDE+ tariffs and budgets

With heat included in the SDE+ scheme since 2012, the potential was there for more specific lobbying around tariffs and budgets for particular heat technologies. An interviewee from ECN (the research organization who advise the Dutch Government on the tariffs) explained that as an organisation they are '*almost constantly*' approached by industry and trade associations trying to influence the SDE+ policy (51) and another interviewee from a large utility also recognised the general importance of ECN's role in the tariff setting process (42).

An interviewee from ECN explained that they consult annually on the costs of heat technologies on behalf of the government and the results of this analysis form the key advice they give to Government on heat (51). The interviewee also explained that ECN are lobbied on much wider points regarding the operation of the SDE+ scheme. While these issues are the responsibility of civil servants rather than ECN, there was a recognition that the lobbying of ECN by industry means the industry concerns are sometimes passed on to the Government via ECN because the relationship between ECN and the ministry is relatively informal and not bound by strict legal requirements (51). This informal and open relationship implies that ECN is seen by the Dutch Government as able to provide legitimate and trusted information on the SDE+ and means that potentially, ECN is a powerful actor in Dutch heat (and perhaps wider energy) policy as well as a target for lobbying.

The interviewee from research institute ECN believed that the SDE scheme is influenced by industry however, this was believed to be only where there is a valid point (51). Interviewees from ECN and industry described a specific success of the biomass industry in causing the splitting of the single biomass category into a small and a large category (44, 51). ECN was the recipient of some of the associated lobbying (51). This policy change was introduced in 2014 and rather than having a single biomass combustion tariff, after 2014 the scheme included a small (between 0.5. and 5 MW) and large biomass tariff (over 5 MW tariffs) in order to provide support for biomass across scales (Netherlands Enterprise Agency, 2014).

The simple triangulation above includes evidence from both an industrial actor and the organization being lobbied (ECN) alongside grey literature which shows the policy change did happen. This implies that the biomass lobby did have the power to affect the SDE and appears to be an example of the first face of power where the biomass industry caused the Dutch Government to do something that would otherwise not have happened. However no further grey literature on this issue has been found allowing only 'part' triangulation.

The UK case study showed that the biomass industry has seen some success around policy change in particular around tariffs for both the non-domestic and domestic RHI schemes and available budgets but doesn't appear to have necessarily caused these changes (policy episodes 7, 11 and 12 respectively).

With regards to the specifics of this Dutch policy change it should however be noted that more recently, the non-domestic biomass RHI tariff in the UK has been merged from a tariff which has three size categories down to just one category apparently for reasons of cost effectiveness (BEIS, 2016); this appears to be the opposite of what has happened in the Netherlands.

Despite the recognition of the importance of ECN around the SDE+, it was believed that the SDE+ had a high degree of flexibility in that it could be quickly modified if necessary as tariffs could be decided by the minister without seeking parliamentary approval (51). This implies that although ECN advises on the SDE+ support levels, the power to actually modify the tariffs sits fully with the Dutch energy minister highlighting the institutional power of the minister. In the UK, changes to RHI tariffs do need to pass through Parliament and can be subject to scrutiny by parliamentarians highlighting a clear institutional difference between the two countries.

11.3.3   Dutch policy episode 3 - The 'Heat Act'

As previously mentioned in section 11.2.4, the Dutch Parliament introduced a law to regulate the heat prices for customers connected to district heat networks which came into force in 2014. The Heat Act is a controversial area of policy and a number of interviewees mentioned concerns around it. One civil servant said simply: '*it's a disaster*' (43). While heat generation rather than distribution is the key focus of this thesis, this section on heat networks is included because the issue of the Heat Act was repeatedly raised (unprompted) as an issue where power and influence was seen to be important. The issue of heat networks was not raised in the same way by UK interviewees.

The Heat Act was initiated in Parliament in 2007 as a result of concerns that consumers on district heating networks were paying too much and that district heat company profits were too high. The key reason the Act was introduced was to introduce the 'not more than otherwise principle' whereby those on district heat should pay no more than those with gas heating (43, 45, 47, 48, 50). This initial bill was produced by members of Parliament rather than being led by the Government in a similar process to the introduction of a private members bill in the UK and was not therefore not official Government policy. According to one interviewee from a sustainable heat network organisation:

'*yeah I was involved for eleven years in the battlefield concerning the heat act, terrible*' (50). He went on to say that the political power behind the bill was extremely strong:

> '*I went to a member of Parliament, I said 'I am a director of a district heating company, these are my annual figures, you can see I don't make a big profit, I make perhaps a too small profit in order to maintain my supply obligations' and he said 'I don't believe you'. I said 'OK that's my problem you don't believe me but here's my statement from the accountant verifying the figures I gave you', he said 'I don't believe him at all as well', I said, 'OK so I have a problem, how can I convince you?' He said 'I don't want to be convinced, I just want to have this law passed and you not to make too much profit, that's it'. I said 'can I do anything for you?'. 'Nothing, just sit still, your hair is being cut don't move'*' (50)

This example highlights a potential limit to the power of evidence as according to the interviewee, the parliamentarian in question was keen to progress the legislation even though evidence suggested it may not be necessary. This example also highlights the power of parliamentarians to propose and push legislation.

There was a recognition that because the Heat Act was introduced in an abnormal process, similar to a Private Member's Bill in the UK, it included a number of incorrect definitions and loopholes (50). One interviewee explained that as a result of the Heat Act, because it introduced a maximum price per unit of heat, for some consumers prices had actually increased because district heat suppliers increased their tariffs up to the maximum level (47).

Using triangulation and the EAR instrument is slightly complex in this example as the issue has been raised by non 'ego' actors. However, with 'thorough' triangulation of sources from both inside and outside Government, it is clear in this example that Dutch parliamentarians had power to introduce the Heat Act and the history of the development of the policy is visible in grey literature (Ministry of Economic Affairs and Climate Policy, 2018b). This example appears to show Dutch parliamentarians having the first face of power to cause the emergence of legislation from the Dutch parliament which would have otherwise

not happened. This power is clearly linked to their institutional power as members of Parliament and can therefore be seen as a more structural or fixed element of power.

Dutch members of Parliament are believed to have acted in the case of the Heat Act because there was a concern that consumers needed protection from district heating companies (43, 47). One interviewee from the Dutch civil service believed that the political concerns around heat networks were generally attributed to direct complaints from consumers (43). It was however explained that despite the fact that the majority of customers who have heat provided by district heating networks are generally satisfied, a small and vocal minority were successful in putting the issue on the agenda (the second face of power); following this, apparently the media saw it as a good story because of the monopoly nature of heat networks and the fact that consumers are unable to switch supplier (48, 50). A grey literature review has identified a three page article in Dutch 'Home' magazine (Eigen Huis) in 2007 which discusses the potential issues with heat networks and interviews a district heat customer who believes they are paying too much for heat; this suggests that there was some media interest in the issue when the Heat Act was initiated. It is however interesting to note, that in considering the introduction of heat price control, the Dutch Consumer and Markets Authority didn't make any references to excess costs or a need for consumer protection with regards to heat networks in a 2009 statement, this suggested that at the time they were not concerned (NMA, 2009).

Dutch civil servants from the Ministry of Economic Affairs explained that in general they did not believe that heat suppliers were over charging and as such the Heat Act would be redesigned (43). Since interviews were carried out, an amendment was made to the Dutch Heat Act in order to correct some of the perceived errors. While the new law is in place, according to the most recent Government 'Explanatory Note' on the amendment, the Dutch Consumers and Markets authority (ACM) has issued guidance on complying with the amended regulations but explain that further clarity is needed from the Dutch Government before the new rules can be fully implemented (Ministry of Economic Affairs and Climate Policy, 2018b).

In the UK, the role of consumers in having any even indirect effect on heat policy appears to be extremely limited and consumers were not involved in any of the policy episodes and did not emerge as important actors associated with heat policy. However, domestic consumer issues, particularly around energy prices have affected other areas of UK energy governance around the regulation of energy suppliers (see Geels, 2014) suggesting the domestic energy consumers have some power. The Heat Act situation in the Netherlands around district heating shows the potential consumer issues associated with increasing the use of district heating, a technology of which the UK Government is generally supportive. While currently UK district heat networks are completely unregulated and prices are at the behest of the network operator, the UK Association for Decentralised Energy (ADE) along with the Chartered Institution of Building Services Engineers has introduced a voluntary best practice guide for heat network operators (CIBSE, 2015). More recently, the ADE has explained that greater levels of regulation of heat networks would not just protect consumers but could also support the growth of the industry (ADE, 2018). The UK Competition and Markets Authority also announced last year that 'Heat markets must be regulated' (Competition and Markets Authority, 2018) suggesting that the UK Government will introduce regulation for heat networks.

11.3.4 Dutch policy episode 4 - The 'Heat Vision'

The 'Heat Vision' was the first official recognition that a transformation of the Dutch heat sector was required and marks a substantial shift in Dutch energy policy (Ministry of Economic Affairs, 2015b).

It was suggested by one civil servant that the Dutch CHP lobby (which was described as '*very strong*' because there is a high proportion of CHP in the Netherlands) was pushing hard for a CHP strategy associated with the 2013 Dutch 'Energy Agreement' in order to increase the capacity of CHP in the Netherlands. '*The CHP lobby, they tried to get in the energy deal, a commitment from the Government to make a policy on CHP, a vision on CHP and they suggested that. They came with a text and we broadened that to a 'Heat Vision' because we always say we don't want to make technology choices … I know it because I did it*' (43). It appears that while the CHP lobby was involved in the early development of the 'Heat Vision', the 'Heat Vision' may

have emerged without them and they were unsuccessful in getting the Government to develop a specific CHP vision. While the 'Heat Vision' did mention CHP a number of times, the vision explained that the potential to increase CHP capacity may actually be limited if this CHP used fossil gas because of greenhouse gas emissions (Ministry of Economic Affairs, 2015b).

Interestingly, in the UK's development of a heat strategy, there was also recognition that the CHP lobby was specifically pushing for the development of a UK heat strategy and similarly, the actual policy impact of the CHP lobby in the UK appears limited (see section 8.8).

Trade associations Warmtenetwerk (which represents heat network developers) and BDHO (which is involved with primarily heat pumps) suggested that they had also been involved with the development of the 'Heat Vision' (50, 49 respectively). It was however not clear how these organisations believed they had had any specific impact and these organisations weren't recognised as being particularly influential by policy makers (43).

According to one interviewee, Gasunie (the Dutch gas transmission operator which is fully owned by the Dutch state (Gasunie, 2017)) was arguing that the removal of gas from heating could cause energy system issues. They suggested that a move to a more electrified heat system as outlined in the vision would cause issues on the electricity system by significantly increasing the peak electricity load and they were seen to be promoting a more hybrid system which retained some gas but combined heat systems with electric heat pumps (41). The Gasunie website doesn't contain any specific response from the company to the 'Heat Vision' document; however the website does explain that Gasunie is a member of the international 'Green Gas Initiative' which believes that '*gas and gas infrastructure are key to achieve EU carbon objectives at a reasonable cost for society and consumers*' (Gasunie, 2015).

There is no evidence gained from interviews with civil servants that Gasunie has had any impact on the development of the 'Heat Vision' or more recent policy developments however the 2016 'Energy report' which was released after interviews took place does suggest a potential role for hybrid heat pumps (Ministry of Economic Affairs, 2016). The arguments around peak heat and the potential role for hybrid systems are very similar to arguments made by gas

companies in the UK in light of the UK Government's heat strategy and the potential for heat electrification (see section 8.10, policy episode 11).

Two interviewees believed that the emergence of the 'Heat Vision' was related to EU legislation (renewable energy targets in the Renewable Energy Directive) (41, 49) and the fact that the Netherlands was not likely to meet its sustainable energy goals without making much more significant progress (43, 49). It is indeed clear from Figure 11-3 (on p293) that the Netherlands has been struggling to increase the proportion of energy from renewable sources at a rate commensurate with its EU Renewable Energy Directive requirement; the 'Heat Vision' document does also make reference to the EU targets (Ministry of Economic Affairs, 2015b). This therefore suggests that the EU (law) had some power in driving the development of the 'Heat Vision' although reducing greenhouse gas emissions was also seen as a key goal in the vision. While the UK's 'heat strategy' didn't appear to emerge as a result of EU law but is more closely linked to the UK's own greenhouse gas reduction targets, it does appear that the EU Renewable Energy Directive (European Union, 2009) did have some influence over the shape of the RHI and its design focus on renewable energy deployment rather than carbon reduction (see section 8.6 which is policy episode 6).

Overall then, the development of the 'Heat Vision' represents an important development in Dutch energy policy and lobbying to support specific technologies within the 'Heat Vision' has been identified. 'Thorough' triangulation has however not shown that any specific actors have driven the development of the vision. Rather, the development of the 'Heat Vision' appears linked to the Dutch goal of a 'sustainable' energy system and concerns around gas import dependency. In the words of the 'Heat Vision' document:

> *'The resource intensity of heat supply puts on our energy consumption also means that sustainable and reduce them is crucial for achieving the transition to a fully sustainable energy system in 2050. This is all the more urgent in view of the reduction of gas production and the decrease in gas supplies in the Netherlands, where the government wants to minimize the import dependency increases from politically unstable regions to meet future natural gas demand.'* (Ministry of Economic Affairs, 2015b)

11.3.5 Section summary

This section has considered Dutch heat policy issues where interviewees have suggested that power and influence may have had an impact. Similarly to the UK, two important areas of heat policy are identified, subsidy support for renewable heat (SDE+) and the long term vision for heat (The 'Heat Vision'). These mirror the RHI and the heat strategy work in the UK. However, interviewees also highlighted the Dutch Heat Act which regulated district heating as another important policy issue and a similar issue has not emerged in the UK.

Actors have attempted to influence the SDE policy, by lobbying Government so that it covered renewable heat. While the scheme does now include renewable heat, there is no evidence that industry lobbying caused this change but there is clear evidence of attempts to influence. However, once up and running it appears from interview data that the biomass industry has been successful in lobbying to split the SDE+ biomass tariff into two scales; this appears to be a direct policy change due to lobbying and can be considered as the first face of power.

With regards to district heating, the first face of power has also been observed as the Dutch Parliament forced through legislation around district heat pricing (the Heat Act) against the will of the Government as a result of perceived consumer issues. In this example, the first face of power can be associated with the structural or institutional power of members of parliament to develop legislation. A similar development in the UK took place around the introduction of the legislation for the RHI (policy episode 2) however in this example, while parliamentarians proposed amendments, it was actually a Government led amendment which was eventually included in the legislation. The legislative change in the Netherlands also appears to have been impacted by a group of consumers who have been able to put the issue of district heating costs on the agenda (the second face of power).

With regards to wider discussions around a transformation of the Dutch heat system, it appears that the development of the 'Heat Vision' has been in the context of wider Government goals rather than specifically being driven by specific actors and this is similar to the UK.

11.4 Approaches to influence Dutch heat policy

This section considers the approaches used by actors to attempt to influence Dutch heat policy which were highlighted in the interviews. The section follows a similar order to chapter 10 which explored approaches to influence in the UK. The first section (11.4.1) considers the role of knowledge and evidence, the second on the use of framing (11.4.2), the third section focuses on situational/institutional factors of different actors (11.4.3) and the final section briefly considers the style of influencing approaches (11.4.4).

11.4.1   Knowledge and evidence

A large number of interviewees recognised the important role of evidence and knowledge in the Dutch heat policy network. One interviewee suggested that there was a general reliance on industry for technological information for policy making (49).

One area in which it was recognised that evidence has been particularly important is around the SDE+. Section 11.3.1 considered the inclusion of heat in the SDE scheme and this was associated with data on renewable heat costs and official advice from research agency ECN which was passed on to the Ministry of Economic Affairs; following the development of this evidence, the ministry supported the inclusion of heat in the SDE (51). It should be however noted that the Dutch government did not believe that heat was added to the SDE because of the ECN data.

Separately, there was a recognition by two interviewees (one from a company and one a civil servant) of the importance of evidence supplied by ECN for the purpose of setting SDE+ tariffs and SDE+ budget allocations by the Government (45, 46). One civil servant explained that the evidence gained from consultation by ECN was particularly important for setting tariffs (46). In fact, one interviewee believed that because of ECN's role they could be a good target to lobby because of their reliance on industry evidence and their importance in setting tariffs and as such attempts had previously been made to influence ECN on offshore wind costs (45). It was however suggested by another interviewee that while ECN does engage with industry, they do not always believe industry data and in one example ECN disagreed with cost data for heat pumps provided by the heat pump industry (49).

This evidence gathering by ECN on behalf of policy makers for the SDE+ is extremely similar to the exercise carried out by consultants in the UK around the development of the RHI tariffs (section 10.1.2) and highlights similar issues with reliance on industry evidence and information asymmetries. It is clear from the data that there have been attempts to influence the SDE+ via ECN in the Netherlands but it is not clear that this approach has resulted in any success. In the UK, while it is apparent that actors attempted to influence the RHI tariffs, it is not apparent that actors actively lobbied consultancies and research organisations in order to try and affect policy outcomes. It is however the case that consultancies engaged with industry in order to gather evidence on behalf of Government. One difference between the two countries is the existence of ECN in the Netherlands which is a semi-public organization which is subject to Government control and is expected to advise the Government on technical energy issues (ECN, 2018). No such organization exists in the UK and the close relationship between ECN and the Dutch Government is something which does not appear to be replicated in the UK case study.

Beyond the SDE scheme, there appears to be only limited evidence of the use of evidence to influence. One interviewee suggested that this may be due to the fact the 'Heat Vision' document contained only small amounts of evidence and data and that further analysis was expected (48). With the development of the more detailed and specific 'Energy Report' (Ministry of Economic Affairs, 2016) this may have changed but this is outside the scope of this research.

Overall, as with UK heat policy, using evidence is an important aspect of approaches to influence Dutch heat policy but successes using this approach appear limited. Approaches to influence using evidence in the Dutch study can be seen to be linked to the third face of power with actors attempting to shape the preferences of policy makers using evidence which is supplied to officials via ECN. It is also the case that some interviewees believed that ECN had provided evidence to the Dutch Government in order to drive the inclusion of heat in the SDE scheme and to get heat on the agenda although this was not confirmed by civil servant, if this was indeed the case, this could be seen as the second face of power.

11.4.2 Framing and ideas in the Dutch heat policy network

As with UK interviews, interviewees in the Netherlands were asked about the use of framing within Dutch heat policy lobbying, including whether the actors used frames themselves or whether they had seen others frame their particular lobbying positions. The use of these frames are considered under Shorten's (2013) typology for ideas. This typology suggests that the use of ideas can be understood as mediated influence (where existing ideas are re-used by actors), unconscious influence (where ideas are used but it is not clear where the idea has emerged from), adoptive influence (where existing ideas are actively adopted), distorted influence (where ideas are deliberately misrepresented) or cumulative influence (where ideas have grown, emerged and developed over time) (Shorten, 2013).

There was a wide recognition from across interviewees that framing was used in attempts to influence Dutch heat policy. One interviewee described how his organisation plays on the views of politicians and explained: '*let's just say we try and treat the message to ignite their interest*' (49).

Figure 11-6 shows the number of times different frames were mentioned by interviewees in the Netherlands. As with the UK section on framing (10.2), quantifying the appearance of certain frames is methodologically complex and it is clear that some frames are related to each other. The most frequently appearing frames with over five references are described in more detail below with the most frequent first.
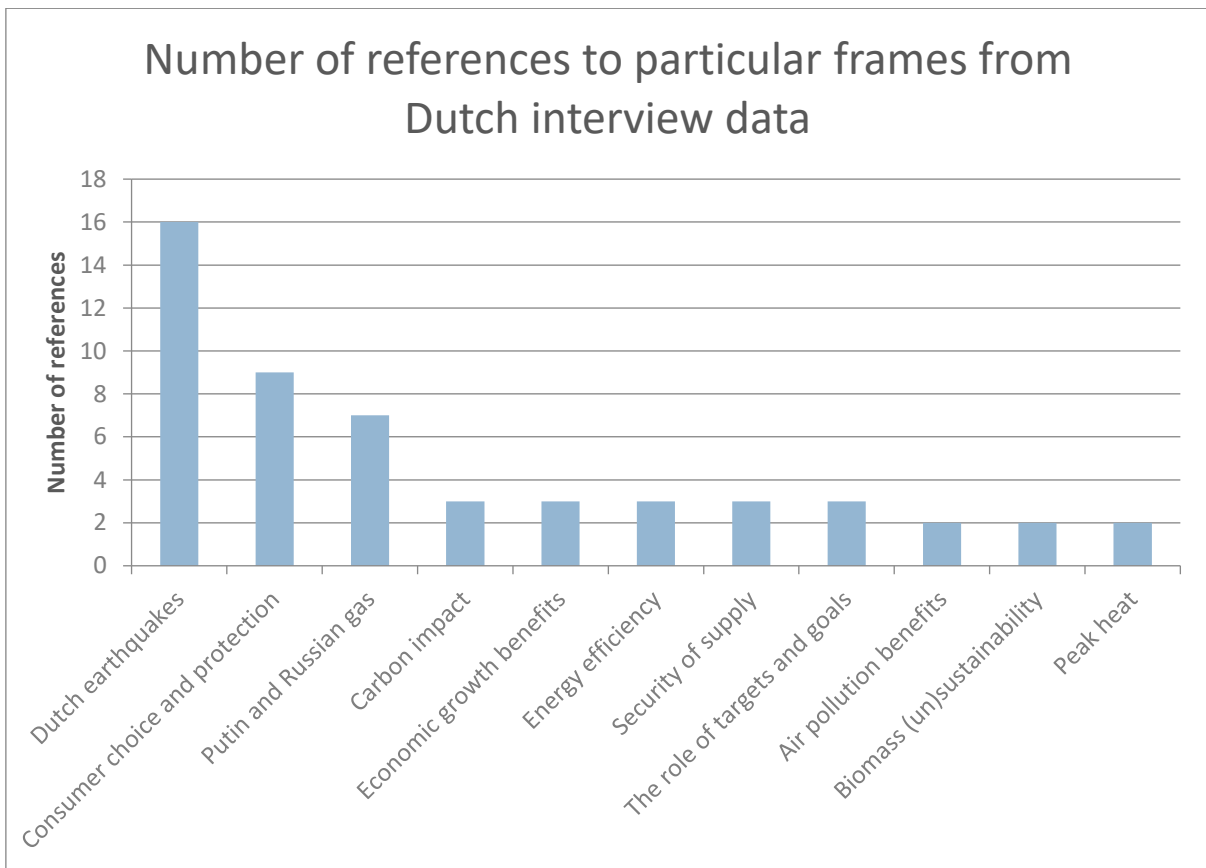
Number of references to particular frames from Dutch interview data

Figure 11-6 Frames by number of references from Dutch interview data for all frames with at least two references sorted by number of references

11.4.2.1 Earthquakes

The issue of earthquakes was recognised as being very important for driving Dutch heat policy. Earthquakes have had a major political and human impact in the Netherlands as households have been damaged and subsequently compensated as a result of the earthquakes (41, 49). It was mentioned that some politicians have even been pushing for the complete removal of all gas production and consumption from the Netherlands (45). One interviewee also mentioned that some residents who had been affected by the earthquakes had installed energy efficiency and renewable energy measures in response to the earthquakes (41). Overall, earthquakes appear to have had a significant social and political impact.

There was also a recognition from the civil servants in the Ministry for Economic Affairs that the earthquake issue had significantly influenced policy (43). The pro-gas frame was extremely weak because of the earthquakes and according to a civil servant:

'If they are trying to influence policy by saying now we should keep on using gas because gas is the best option and it's the least dirty option next to renewables, at this moment people say 'shut up…go away'' (43).

Even the Government itself no longer talked about the benefits of gas. The quote below concerns a discussion between three civil servants regarding the Dutch gas trading hub project during one interview:

'Civil servant 1: I have a small question, is the gas roundabout a part of what we want?

Civil servant 2: It's finished, it's there.

Civil servant 1: But in the 2011 'Energy Report' it was a goal to invest more and become a hub

Civil servant 2: Well a lot of that has been done but we now officially say that that's finished

Civil servant 3: I think we also say that because we don't talk gas

Civil servant 1: So it's no longer a chapter in the 'Energy Report'?

Civil servant 2: No, but we are very strong in gas…but we are not allowed to say it' (43)

There was also a view from two interviewees that the power of the Dutch gas industry had been reduced by issues outside of their direct control. It was explained that due to the earthquakes in Groningen, '*Everything connected to gas here is infected at the moment*' and as a result, the political power of gas companies has been weakened (43). One interviewee from a sustainable heat interested trade association explained that policy makers simply ignore gas companies (43). Another suggested that their image is '*down the drain*' and added that as well as the earthquake issue, the science of climate change is so compelling that companies can no longer argue against decarbonisation (44).

It was believed that because earthquakes happened at the time the 'Heat Vision' was being developed, low-carbon heat technologies were being given a '*level playing field*' compared to gas which could have otherwise dominated policy discussions around the future of heating (45). One interviewee suggested

that the earthquake issue was significantly affecting the Dutch heat discourse and suggested that the whole '*atmosphere, the total mood*' related to gas in the Netherlands is changing, which has weakened gas and put sustainable heat in a more effective lobbying position (49). He went on:

> '*You can imagine if they* [the gas industry] *now would come up with a kind of bull shitting approach trying to diminish our role, we have good arguments to fight back and we do*' (49)

Another interviewee from a heat network organisation explained: '*now we are finding we have another ear, a far more interested ear and I don't think this can be attributed to all our efforts but at least we can benefit from it*' (50).

Overall, the earthquake issue has clearly had a significant impact on Dutch heat policy which is believed to have reduced the power of incumbents and increased the power of sustainable heat actors. While actors may have used the issue to frame their own policy changes, it appears that the issue is so powerful that actors interested in sustainable (non-gas) heating don't necessarily need to actively apply the frame and can instead simply rely on the fact that they are relatively popular compared to gas. Because of the passive nature of the earthquake issue in empowering sustainable heat actors, it is not clear how much value Shorten's typology is for understanding the power of ideas in this example. However, where actors have actively used the earthquake issue to frame their policy asks, this could be seen as 'adoptive influence'.

11.4.2.2   Consumers and protection

The next most frequently referenced frame from the Dutch interviews was around the issues of consumer prices and consumer protection.

One interviewee suggested that the idea of consumer safety could be used as an argument to move people off gas and explained that she had heard a district heat consumer explain: '*I'm actually quite happy that my old neighbour who is getting a little bit crazy is not using gas, so from a safety perspective gas is no longer the best option so you see in dense cities or apartments where you don't know each other that well*' (41).

However, the majority of comments regarding consumer issues referred to the fact that district heating customers couldn't switch suppliers and the belief that the companies were making excess profits (41, 42, 47, 50). One interviewee explained simply '*The idea of being able to switch is very important and DH does not allow this*' (42). The framing around an inability to switch could be seen as 'adoptive influence' under Shorten's typology as existing ideas are re-used by actors as required.

While these consumer issues were recognised as important frames, there was no evidence from the interview data that attempts to use these frames had any sort of influence on the development of Dutch heat policy. However, the introduction of the Heat Act has been associated with consumer concerns.

11.4.2.3   Putin and Russian gas

The next most frequently mentioned frame was associated with the potential for the use of Russian gas or mentions of the Russian president Vladimir Putin. As reported earlier, the Netherlands only became a net importer of gas last year however, imports of gas from Russia have been rapidly increasing, doubling from around 6 billion cubic meters in 2014 to around 12 billion cubic meters in 2016 (Interfax Energy, 2018).

There was a suggestion that the diplomatic relationship between Russia and the Netherlands had been damaged since the shooting down of the MH17 Boeing jet flying between Amsterdam and Malaysia in 2014 which had killed a number of Dutch citizens and was which had been attributed to Russian weapons (45). It was also believed that this situation, combined with the earthquakes put the Dutch Government in a very difficult position as they could neither rely on indigenous gas nor imports from Russia (45).

Interviewees suggested there was a general anti-Putin feeling in the Netherlands (49, 50). However, there was a recognition that Putin and Russia had created a beneficial environment for sustainable heat polices and one interviewee associated with heat networks explained that for district heating which has its own issues around consumers: '*we noticed that Mr Putin is a bigger enemy than we are so he even has a worse image with the customer than ourselves so we can use him more*' (50). He went on:

'It's incredible how this works, if you talk to customers and do a presentation and your 4th or 5th slide shows a nice cartoon or picture of Mr Putin and say this is the alternative and everybody is OK we don't want this so let's hear more carefully what this man has to say, it really works like this, incredible. Strange, I understand it really works.' (50)

Overall the perceived issues with Russia and Russian gas in the Netherlands meant that gas was often seen negatively and interviewees explained that these issues could be used to frame the benefits of low-carbon heat. However, the evidence does not show that this framing has actually had an impact on the development of Dutch heat policy. Interestingly, the negative image associated with Russian gas appears to have a similar image to the earthquake issue and is also believed to have empowered actors involved in non-gas forms of heating. The use of the Russian gas frame could be seen as a form of adoptive influence under Shorten's typology as the frame has been actively adopted.

11.4.2.4   Other frames

As well as the most frequently used frames mentioned above, interviewees recognised the use and importance of a number of other frames.

There was a wide recognition that the ability to reduce carbon emissions was a very important aspect of the debate (44, 48). Some interviewees also mentioned the importance of economic impacts of particular policies, recognising the difficulty of reducing gas production for the Government's tax take and the benefits that the income from gas has had for the country (41, 43, 48). There was also a belief that the value of the energy efficiency frame had also become increasingly important (47, 48) as well as the general importance of using the frame of security of supply (43, 48, 50).

A small number of interviewees mentioned other frames including the sustainability issues of using biomass, reducing costs, the peak heat issue associated with electrification and air pollution among others.

11.4.2.5   Section summary

In general, the use of framing in the Netherlands is seen to be an important element of heat policy influencing activities and many of the frames recognised as important by interviewees are similar to those used in the UK. However, the

most frequently recognised frames are very different to the most popular frames in the UK as a result of specific Dutch issues, in particular the earthquakes associated with the Groningen gas field and the relationship between the Netherlands and Russia. These two issues are used as frames by those looking to influence and appear to have empowered actors involved with sustainable heating while disempowering those involved in gas. The framing used in the Netherlands could be primarily considered as adoptive influence under Shorten's typology; while much of the framing in the UK can be considered as adoptive influence, the UK analysis also highlighted distorted influence which wasn't discovered in the Dutch research.

11.4.3 Scale and situation

Following the structure of the UK chapter around approaches to influence, this section considers the type of actors involved in influencing as well as lobbying targets and considers how the relative position and type of actors can be liked to power and influence over Dutch heat policy. The key aspects associated with scale and situation are broken down in more detail in the following sections.

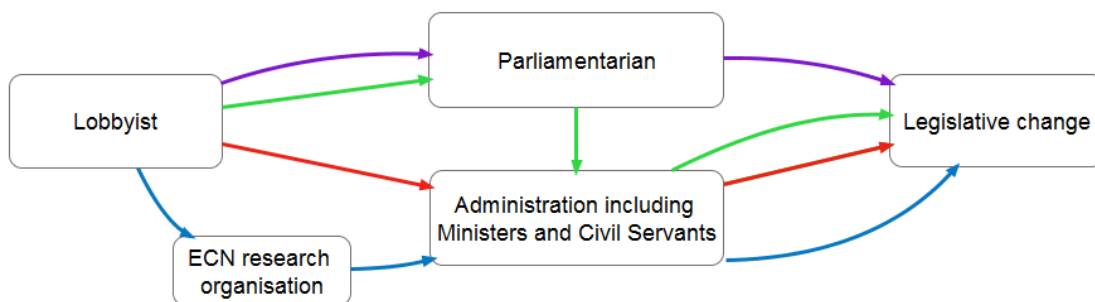#### *11.4.3.1 Routes to influence*

As in the UK, Dutch interviewees described various routes used to attempt to influence policy. Heat actors were seen to be involved in both parliamentary lobbying as well as administrative lobbying where they would engage with the department responsible for energy (41, 42, 46) and also the Ministry of Finance (48). Whilst the interview data did not show that consumer organisations were lobbying parliamentarians regarding the costs of district heating, one example of parliamentary power within Dutch heat policy (described in section 11.3.3) is the development of the Heat Act which was driven by politicians (apparently as a result of being lobbied by vocal consumers) who developed the legislation (43).

For the SDE+ policy there is evidence from interviews of lobbyists attempting to influence the tariffs and policy through both the Ministry of Economic Affairs directly as well as through ECN, the research organisation which is heavily involved in advising the Dutch Government on various aspects of the SDE+.

The evidence from the Netherlands shows that four routes can be identified from interviews to influence heat policy and these are shown in Figure 11-7. Firstly, as shown by the purple line is the purely political route such as that

behind the development of the Heat Act. The route in green shows the political-administrative route where lobbyists engage with parliamentarians in order for those parliamentarians to then engage with the administration; the evidence from interviews shows that during the development of the Heat Act in Parliament, there were indeed pressures from Dutch Parliament on the energy department although it was the Parliament that developed the Heat Act. The red and blue routes have also been used in order to attempt to influence the SDE+. The red route, the administrative route, is used by lobbyists engaging directly with the department and the blue, which I term the quasi-administrative route shows lobbyists engaging with ECN (who advise the Ministry of Economic Affairs on the SDE) in order to influence policy.

The purple, green and red routes are the same as the routes seen in the UK. However, the blue route is unique to the Dutch study specifically because of the role of ECN in supporting and advising the Dutch Government on the SDE+ policy and there is clear evidence of lobbyists looking to use this route. While in the UK study, consultants have been used to support policy development, active engagement with these consultants in order to attempt to influence policy has not been identified and consultants appear to have been less closely connected to the UK Government than ECN are connected to the Dutch Government.

Key

Political lobbying

Political-administrative lobbying

Administrative lobbying

ECN lobbying

Figure 11-7 Routes to influencing policy change in Dutch heat policy

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11.4.3.2   *District heat network operators*

There are already a number of district heating projects in urban areas in the Netherlands with 4.5% of homes connected to heat networks and the Dutch Government expects the number of schemes to increase as part of their energy transition (ECN *et al.*, 2016). There was a recognition that the municipal Governments who tend to own local heat networks including Amsterdam and Rotterdam work closely with central Government to help develop policy particularly around district heating (41, 48, 50). There was also a belief that district heating networks were relatively powerful in the Dutch heat policy debate (45).

It was also suggested by one interviewee from a heat network advocacy organisation that because municipalities who often own the energy infrastructure, such as district heating, have legitimacy with central government policy makers, there was merit in the private sector working with municipalities. '*A civil servant listens to a civil servant and on the country level as well as the provincial or municipal level they more or less like each other or they are more inclined to listen so we use those local politicians we use more frequently nowadays, it has been very effective*' (50).

While the interview data has not shown that district heating organisations or municipalities in the Netherlands have had any major policy successes, the data does show that district heating organisations and the municipalities often behind them are seen to be particularly powerful actors. While the UK study wasn't specifically focusing on district heating, interview data did not show that district heating operators and local authorities were seen as particularly powerful actors or had any particular policy success. This difference between the two countries could be linked to the fact that the UK is known to have very high levels of central Government control on fiscal and wider policy (IEA, 2015) whereas in the Netherlands municipal Governments are much more powerful; this is reflected in the 'Energy Report's' requirement for Dutch regional governments to develop and then lead their own heat transformations (Ministry of Economic Affairs, 2016). This difference between the two countries could also be linked to the differing market structures between the two countries with much of the Dutch gas and heat network infrastructure owned by municipalities interested in

social benefits but with British gas and heat infrastructure mostly owned by the private sector interested in financial profits.

These major differences between the two countries could be an interesting area for further research as both countries are looking to expand the role of district but have very different institutional settings; the power of the Dutch municipalities could be an important driver of low-carbon heat in the Netherlands which UK does not have.

11.4.3.3 Trade associations

Unsurprisingly, two interviewees from trade associations mentioned the important role of trade associations in the Dutch heat policy network. One suggested that trade associations could make the life of Government much simpler by providing cross industry views and a balanced and 'middle position' (48). Another suggested that trade associations are able to provide the most up to date information to Government and suggested the Government actively seeks the views of trade associations (49). There was also a belief that trade associations, because of their scale, could be involved with many different aspects of policy and politics. For example, some trade associations are part of much larger organisations which have close connections to Parliament and therefore have a good understanding of political developments (49).

However, it was suggested that trade associations representing heat companies weren't particularly influential because it was not the associations themselves but their member companies which actually held the more detailed cost and performance data (50, 51). According to an interviewee from ECN: '*it's actually the combination of a good trade association with a specific company that can lay down the numbers and only that combination is most effective in changing the legislation*' (51).

Trade associations in the Netherlands saw themselves similarly to how trade associations are perceived in the UK where they are seen to act as a buffer for information and make the lives of policy makers easier by representing sectoral views and reducing the need for Government to speak to multiple organisations (see section 10.3.4). However, whilst trade associations in the Netherlands believed they were seen to be legitimate sources of information by policy makers, the interviews did not highlight that they were actually viewed as

legitimate and no particular heat policy changes as a result of trade associations were identified. It was also recognised that good data from companies (rather than trade associations) was also required for policy making.

11.4.3.4 *Growing power created by policy*

A number of interviewees including both civil servants and representatives from trade associations believed that developments around heat policy and the 'Heat Vision' were empowering sustainable heat actors and giving them the ability to have more influence over policy. One interviewee suggested that because of the development of the SDE+ to include heat, heat actors had become much louder within the policy debate (46). It was also recognised that the momentum around sustainable heat in general had increased (47) and that heat was moving into an '*improving position*' (48). One interviewee explained that the lobbying capacity of the heat actors was increasing as they were becoming more competent and engaging with policy makers (51).

This is similar to the situation in the UK where both the policy focus itself had put heat issues on the agenda and where policy had also grown the renewable heat (primarily biomass) industry.

11.4.4 Style

This final section of the Dutch approaches to influence section considers the style of those looking to influence. A number of comments by interviewees suggested that the style of communication was an important aspect of the way actors communicated their lobbying positions. One important approach was to provide measured and supportive comments rather than going against the Government. One interviewee described using a '*constructive and open dialogue…trying to help them solving problems*' (48). Another interviewee described the importance of a '*balanced position*' (50) and another explained that trade associations are quite often able to provide this balanced view (51). This approach of balance and offering support and positive relationship was also recognised as being important within the UK study (see section 10.4).

Similarly, it was also believed by one interviewee that having an approach which provided an integrated view which takes into account wider issues across the market was seen as being important (48). The district heating association took a similar view and explained that their message did not sell district heating

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as a panacea for heat supply in all areas but supported it where it was most beneficial (50). The value of this integrated view appears to echo comments regarding trade associations in the previous section who can be seen to represent cross sector views rather than the view of a single company (section 11.4.3.3).

It was recognised by civil servants in the Ministry of Economic Affairs that an '*open*' approach to engagement by industry was generally positive and conducive to good policy making, however they also recognised the potential for industry to covertly attempt to influence policy: '*it is our task to weigh all those arguments and see which one is true and which one might not be as strong as they are making it sound*' (43). Overall, while the Dutch case study showed that actors used a generally constructive style to engage, the data didn't indicate that this approach had any particular impact on policy.

The UK study highlighted that as well as using constructive approaches, some actors in the UK also used aggressive communication approaches in their attempts to influence heat policy. These sorts of approaches were not encountered during the Dutch case study.

11.5 CHAPTER CONCLUSIONS

The Dutch case study provides a valuable comparison to the development of heat policy in the UK. The Dutch space heating regime is very similar to the UK's, with both primarily reliant on natural gas for heating. Both also have rapidly diminishing indigenous gas resources and the countries also have similar EU 2020 renewable energy targets. As a result, both countries have policies to support the deployment of renewable heat and have long term visions for heat which include plans to expand district heating and electrify a proportion of heat demand.

In both countries, power has affected the development of policy although power struggles associated with district heating have been a much bigger element of Dutch heat policy. This could be because district heating provides a greater proportion of heat in the Netherlands than it does in the UK. A major impact of power on heat policy in the Netherlands is associated with the development of the Heat Act, which aims to protect customers on district heating networks. While this law was introduced by the Dutch Parliament, as a result of issues

with the Act, the government has amended this legislation. This research has also identified evidence of actors looking to influence the SDE+ policy which supports the development of renewable heat and has shown that actors have had some success in influencing this policy around the rules for biomass combustion.

In both the UK and the Netherlands, it is also the case that as heat policies have promoted sustainable forms of heating, the noise and scale of attempts to influence have increased.

There are also some significant differences between the UK and the Netherlands. Institutional factors such as municipal ownership of networks, and geographical factors such as the situation of gas supplies mean that the shape of the policy network and the different aspects of power within it vary between the UK and the Netherlands. The relatively large role of municipally owned gas networks in the Netherlands means that heat policy power appears to be more skewed towards municipal authorities (who appear to be trusted by policy makers) in the Netherlands and a similarly trusted network owner does not exist in the UK. One other significant difference is that in the Netherlands, the issue of earthquakes and concerns over Russian gas dominate the heat policy discourse, acting as a driver for sustainable heat and weakening the power of actors associated with the gas industry who are likely to be keen to promote a longer term role for gas. No such obvious anti-gas frame exists in the UK heat discourse.

Both the Dutch case and the UK research has highlighted attempts by the biomass and CHP lobby to influence heat policy. The biomass industry appears to have had some success in the Netherlands but limited policy influencing success in the UK. However, the success of the CHP lobby appears limited in both countries. Nonetheless, as in the UK, in the Netherlands, biomass combustion has dominated the delivery of renewable heat.

The role of evidence has been highlighted as an important factor in the development of policy in the Netherlands as it has in the UK. In the Netherlands, ECN has a particularly important role with no equivalent UK organization funded and relied on by the Government for energy analysis. In both situations however, policy makers need to take significant consideration of

the data that is being used for policy making purposes because it is such an important aspect of policy design in particular the setting of tariffs for renewable heat support policies.

With regards to how theoretical understandings of power relate to the Dutch case study, the first, second and third faces of power have been acknowledged. The first face seems to be present in the biomass industry's ability to influence the SDE policy as well as with the Dutch Parliament's ability to develop the Heat Act. It should however be noted that the development of the Heat Act was linked to the institutional power of Parliamentarians which could be seen as a more structural element or power. The second face of power has also been acknowledged, as the issue of district heat costs appears to have been put on the agenda of Parliamentarians by consumers and the issue of renewable heat was believed to have been put on the Government's policy agenda by ECN (although this was not confirmed by civil servants). Finally, the third face of power has been recognised in attempts to frame policy changes and with the use of knowledge; both can be seen as approaches which shape the preferences of policy makers in order to affect policy change. The fourth face of power has not been specifically identified in this analysis and this may be due to the limited scope of the case study and the focus of the research on more active attempts to have power. The fourth face of power could however potentially be associated with approaches which include evidence and knowledge. Finally, the Dutch case study has not highlighted any examples of groups of actors working together to have power suggesting that ideas of 'intransitive power' have not been particularly important in the developments considered.

Based on this research, the UK could take some learning from the Dutch heat policy experience so far:

- Some administrative changes to Dutch renewable heat support policies (for example to tariff levels) can be made without Parliamentary approval. If the UK adopted a similar approach, while this may reduce democratic oversight, changes to policies such as the RHI could be much more rapid and responsive.
- The Dutch experience of earthquakes caused by gas extraction has led to a social movement against gas use which appears to have

empowered sustainable heat actors and depowered incumbents. No such anti-gas vision exists in the UK and because of the lack of this push factor, heat decarbonisation may be harder to drive in the UK.

- The Dutch Government has a good relationship with municipalities and municipalities are trusted sources of information on energy issues who are tasked with developing local heat plans. Municipalities also often own a significant share of energy network infrastructure. The UK has neither a strong relationship between national and local Government on heat issues nor a requirement on local authorities to develop heat plans. A better relationship between local authorities and the national UK government, alongside a requirement for locally led heat planning and municipal ownership could support UK heat decarbonisation.

- The Dutch government uses an independent and public advisor (ECN) to advise on cost and technical issues to do with energy and ECN provide what appears to be objective and reliable information. No such body exists in the UK and more formalised cost and technical information provision on energy could support UK heat decarbonisation policy.

- The 'Heat Act' policy in the Netherlands has been an abject failure. UK heat network regulation is needed but a simple 'must cost less than gas' approach to cost regulation is unlikely to be suitable.

While there are a number of lessons that the UK government may be able to take from the Dutch approach to heat decarbonisation, it is unclear that there is currently much that the Dutch could learn from the UK. The UK RHI scheme has deployed well below expected levels and has not deployed the types of technologies expected and the UK's long term heat strategy appears deeply uncertain.

Overall however, many of the similarities between the two countries are reflected in the recent developments of policy and the associated power struggles. While there are strategic differences around gas supply issues and the structure of the energy markets meaning that the two countries are not always directly comparable, it may make sense for the UK to work with one of its closest neighbours as both countries attempt to decarbonise heat systems which currently primarily rely on gas.

12 CONCLUSIONS, REFLECTIONS AND IMPLICATIONS FOR POLICY

This thesis has investigated elements of power associated with the UK's potential transformation to a sustainable heat system and used the Netherlands as a comparative case study. Specifically, the research has examined the ability of, and attempts by, actors to have power to affect policy associated with the heat transformation. To recap, project research questions were:

1. How has UK heat generation policy been affected by the power of actors?
2. What approaches have been used by actors to attempt to affect UK heat policy?
3. Do ideas have power as frames in the heat policy process?
4. How can understandings of power which emerge from this research be used to strengthen the multi-level perspective on transitions?

Through combining elements of the multi-level perspective, theoretical approaches to power and ideas of power and policy change, a 'transformation policy power framework' was developed (introduced in section 6.2, Figure 6-1, p130) to visualise how theoretical understandings of power may be seen to be associated with the different elements of the UK's heat system. Within this thesis, power has primarily been considered under the 'four faces' approach although consideration has also been paid to whether power can be seen as agent based or structural. Power is also considered from the perspective of 'power over' or 'power to' (transitive and intransitive power respectively).

In order to investigate the framework and the power of actors to affect policy, a triangulation approach based on the 'EAR' instrument was used which has never before been applied to UK energy policy. Data was collected through a number of interviews with those involved in the policy process. Interview data was analysed by comparing the views of lobbyists with policy makers alongside a detailed investigation into relevant grey literature. A smaller comparative Dutch case study was also carried out.

This chapter draws together the key conclusions of the thesis, considers the key issues raised by the research and introduces some potential solutions to these

issues. Overall, this thesis has presented original research associated with power, influence and UK energy policy and used a triangulation methodology which hasn't been used before in a UK context. The research develops a UK literature on power and energy policy where few previous examples of academic analysis exist. The analysis is particularly novel in considering the impacts of actors on specific policy changes. Much of the previous research on energy lobbying in general has considered only attempts to influence rather than the actual impact. The case studies and findings also add value to understandings of power in the field of sustainable transitions. The transitions literature has been critiqued for not considering issues of power in enough detail and this research responds to calls for researchers to consider how power and policy development may impact sustainable change.

The first section (12.1) of this chapter looks to answer the research questions which were introduced at the start of the thesis and also re-introduces the theoretical model: 'The transformation policy power framework', which was first introduced in chapter 6. The model is updated in light of empirical results.

The second section of this chapter (12.2) considers some generalizable findings regarding power which have emerged from the research and discusses some of the similarities between the UK and Dutch case studies. This section also considers the fit and contribution of this thesis to the wider, associated literature and goes on to consider areas for further research.

The third section (12.3) pulls together methodological and theoretical issues which have been discussed in the results and discussions chapters and explores how these issues can be considered alongside the general issues associated with considering and analysing power. This section also considers some personal reflections on the methodological issues associated with researching power.

The fourth and final section (12.4) introduces some recommendations for policy makers which have been developed based on this research.

12.1 PROJECT SUCCESSES AND CONSIDERATION OF THE PROJECT RESEARCH QUESTIONS

The thesis has delivered two case studies associated with power and heat policy change. The thesis has also delivered an original application of a specific theory of power to an example of a transformation and has provided a research focus on the issue of heat policy.

A key issue highlighted in the methodology section was associated with the potential lack of data on power as a result of issues to do with confidentiality and interests and general interviewee concerns. It was expected that interviewees would be very cautious about making comments. However, this issue did not materialise and in fact, the detail and honesty of interviewees has been surprising. One clear unavoidable difficulty with this research has been associated with limited access to relevant grey literature. This has meant that in some elements of the thesis, full data triangulation has either been limited or not possible and therefore it has not always been possible to identify if a particular power issue has been affected by the power of actors. However, the analysis has provided a detailed description of the actors involved in attempting to influence heat policy and the approaches used.

The following sub-sections consider the project research questions in light of the results discussed in the previous chapters.

1. How has UK heat generation policy been affected by the power of actors?

The thirteen policy episodes described in chapter 8 describe the key policy changes where power was believed to have had an impact. While all these episodes showed evidence of actors attempting to influence policy change, the analysis of the available, and necessarily limited data, only showed that actors affected policy change in a small number of episodes. Table 6 on page 208 contains all these policy episodes and summarises how different theoretical elements of power appear in each of the episodes.

The first area where actors have had power over policy concerns policy episode 2, where a coalition of actors, led by the REA caused an amendment to the 2008 Energy Act which effectively created the Renewable Heat Incentive. This

episode highlights the ability of actors to drive policy change associated with promoting sustainability.

The second area where an actor appears to have had power over the RHI was the splitting of the RHI into the non-domestic and domestic schemes (policy episode 6). Interestingly, rather than this change happening as a result of lobbying, it was the DECC permanent secretary who had the power to cause this change and this suggests that when considering the power of actors in policy change, researchers should look beyond just lobbyists.

The third area where the results highlight that actors have had power is around the UK's long term strategy for heat (policy episode 10). While linked to the provision of useful evidence, the gas industry was successful in reducing the rate and level of electrification of heat in the Government's 2013 'meeting the challenge' paper (DECC, 2013k). This change indicates the power of incumbents to affect Government visions on sustainable futures.

The fourth and final area where the results show that actors have influenced UK heat policy is around the favourable treatment of biomethane considered in policy episode 13. Evidence shows that landowners involved in biomethane projects were successful in maintaining RHI biomethane tariffs which were expected to see reductions and were also successful in reducing the impact of the introduction of sustainability criteria. This episode highlights the impact that actors can have on specific, and primarily administrative, policy issues which can have significant real world consequences.

The comparative Dutch case study also showed that actors had influenced the development of Dutch heat policy. Specifically, the biomass industry had successfully affected the SDE subsidy scheme tariffs for biomass and separately the Dutch Parliament had power to introduce the Dutch Heat Act.

While the clear power of actors has only been shown in a small number of episodes, the other episodes highlight the complex nature of power and policy change. They show that policy change can be linked to a combination of factors including power, knowledge and evidence, wider Government agendas and institutions. Overall, while the power of actors can be an important driver of policy change, the research shows that the wider (policy) context must always be considered too; indeed, the EAR instrument already has a requirement for

the consideration for external or autonomous elements associated with policy change (Arts, 2000).

Because this research has shown that actors have already had power over elements of policy change associated with the UK's heat system transformation, it can be expected that actors will continue to attempt to influence and continue to have power. While this may not come as a huge surprise and indeed one would expect actors to be able to shape change, a key issue will be if powerful actors attempt to and successfully constrain or shape the UK's transformation in line with their own interests. If heat policy reflects the interests of powerful actors, then the impacts of policy are likely to primarily support those with power rather than primarily supporting the rapid transformation to secure and equitable low-carbon heat. It may not necessarily be that those with power want to slow or stop decarbonisation. However, clearly some actors are attempting to shape heat decarbonisation policy in a way that suits them and if successful they could stop, slow or shift the heat transformation away from social and environmental goals.

It is not possible to say exactly what the impact of political power on the UK's transformation to low carbon heat has been or may be in the future. The introduction of the RHI policy appears to have been sped up by the Renewable Energy Association and a wider coalition potentially increasing the total amount of renewable heat deployed. However the scheme was also slowed down by civil servants reducing the overall deployment of low carbon heat. The RHI also appears to have been influenced by biogas interests who have, as a result of their influencing, seen unexpected biogas growth and a reduction in sustainability requirements (although these requirements have since been tightened). The gas industry also appears to have had some success in increasing the role for gas in the Government's 2013 framework for heat although whether this has had any impact on the UK heat system remains to be seen. Overall, this analysis has highlighted that power (on policy) drives the heat system in various directions rather than having a uniform impact. And while the impacts of power which have been identified may be material over the time period studied, there is little to suggest that the direction of influencing will remain constant over time.

The impact of certain vested interests in this analysis is clear and heat policy has been affected by actors. Based on the results of this research, section 12.4 introduces some policy recommendations which may limit certain elements of the power of vested interests.

2. **What approaches have been used by actors to attempt to affect UK heat policy?**

The results highlight a wide range of approaches used by actors to attempt to influence UK heat policy. Fundamental to all approaches discovered from this research, is the engagement by those private interests looking to influence policy with Parliamentarians (i.e. MPs and Lords) and the relevant administrations (i.e. Government departments including Ministers and civil servants) or a combination of both.

The activities of those looking to influence are nearly always linked to the provision of evidence from actors to the Government or Parliamentarians and these efforts have related to both the UK's long term heat strategy and the Renewable Heat Incentive. The importance of evidence is linked to the fact that civil servants are required to make objective decisions. It has also been recognised that the Government's knowledge on low carbon heat has been relatively limited. Good evidence is therefore seen as valuable to policy makers and so those with evidence which is seen as legitimate and valuable can be seen to have power over policy makers. In many ways, knowledge is power.

Knowledge is exchanged between influencers and policy makers in a number of ways. This includes through:

- Direct one-to-one engagement such as from a company to a civil servant on the costs of a particular technology;
- Through consultations such as those concerning the RHI;
- Through the sharing of analysis carried out by consultants including modelling exercises such as those investigating the optimal long term future heat system produced by the gas industry (e.g. Delta ee, 2012; HHIC and Delta ee, 2013).

This research has also shown that the scale and situation of those looking to influence can be an important element of approaches to influence. Large

integrated companies use the fact that they work across the market to provide what they believe is perceived as balanced and objective information, an approach also taken by trade associations. However, small companies were seen as having power because of the fact that they can provide specific information about technologies and can be open and honest. Overall, the evidence showed that actors working together (having intransitive power) can increase the power of actors. This of course relies on actors sharing goals, which as has been shown in this research, is not always the case.

The analysis has also shown that those attempting to influence heat policy shape their style of communications, with approaches varying from balanced and objective to frightening and threatening. The specific use of the approach of framing is considered in the following section.

The results from the Dutch case study show very similar results to approaches to influence in the UK, again highlighting the importance of knowledge and evidence. However, the Dutch study described some significant differences in issues of power between the two countries, resulting from a different institutional situation. The existence of public research organisation ECN, which advises Government and the municipal ownership of elements of energy infrastructure in the Netherlands, means that power structures are different to those in the UK at the time of analysis. The impacts of earthquakes caused by gas extraction in the Netherlands has also had a major effect on Dutch heat policy.

Overall, a wide range of approaches to influence are available however, all rely on an actor having the capacity both to engage and also to engage effectively. This requirement for capacity means that small actors are always likely to struggle compared to larger actors when attempting to influence policy. This capacity issue is closely linked to ideas of economic power which can see political and economic power as closely related (Strange, 1975). However, this research has shown that some relatively small actors (companies 'A' and 'B' discussed in chapter 9) have chosen to invest significant amounts of time and capital into policy influencing activities, and are recognised as being vocal actors. It should however be noted that despite being vocal these companies do not appear to have had any significant policy impact.

In general, evidence from this research suggests that those looking to have power over policy change should focus on a combination of:

- Working together with other organisations with similar goals;
- Understanding the true structure of Government power (and how Government works);
- Producing and providing legitimate evidence;
- Developing and using Parliamentary and administrative connections.

3. Do ideas have power as frames in the heat policy process?

Overall, the use of framing as an element of influencing activities was recognised by both those looking to influence and policy makers. Even policy makers suggested to lobbyists that there was value in actors framing arguments in particular ways.

Rather than being a key approach to influence or have power, framing is used as a tool within wider approaches to influence. The results highlighted the use of numerous frames which link to various issues including Government goals and targets, technology performance, concerns over consumer issues and wider economic issues. Based on the typology for ideas (closely linked to framing) which was introduced in chapter 7 (Shorten, 2013), two key types of framing were identified in the UK analysis, 'adoptive' where ideas (frames) are actively adopted and used by actors and 'distortive' where framing is based around the purposive misrepresentation of ideas.

The research highlighted that actors believed that the value of certain frames had changed over time in the UK heat policy discussions. In particular it was believed that it had become increasingly valuable to frame policy asks around ideas of economic growth and carbon reduction rather than the deployment of renewable energy. However, within the policy episodes identified, while framing was clearly used by actors, there is no evidence that framing drove any specific policy changes or that certain approaches to framing were more influential than others.

The Dutch case study highlighted significant differences in framing in the Netherlands compared to the UK. Specifically, concerns around the sourcing of natural gas dominated both policy discussions and approaches to framing; this

was all driven by the earthquakes at the Groningen gas field and concerns over sourcing gas from Russia.

4. How can understandings of power which emerge from this research be used to strengthen the multi-level perspective on transitions?

Empirical findings from this thesis strengthen the MLP in a number of ways and open up routes for further research into power and transitions. Firstly the thesis provides an interesting case study for scholars involved in sustainability transitions research who are interested in power and policy and the thesis follows calls for a much greater consideration of power in transitions research. This study also provides a UK case study considering power and sustainability transitions. Previously much of the investigation of power and transition has focussed on the Netherlands.

Secondly, this thesis follows specific calls for the use of the 'three faces of power' model by Geels' (2010) and uses an approach which take into account three faces and adds a fourth dimension. This work also builds upon Smith et al's (2010) suggestion that MLP approaches would benefit from '*opening the black-box of public policy*' (p446).

Thirdly, while there is a growing literature considering issues of power and transitions in general, this research provides the only case study specifically considering the power of actors in affecting policies associated with a systemic transformation. However, because of the unique nature of this study it may be hard to draw general conclusions about power, policy and transformations. In this study alone, attempts to have power have been associated with driving change in various directions reflecting various interests and the impact of power can be considered as multi-directional. In a general sense, it is however possible to say that attempts to have power and the impacts of power on the policy associated with the transformation of the UK's heat system have been identified from the research. Overall, the power of actors to affect policy can be an important element of sustainable transformations potentially shaping or slowing change. The power of interested actors to affect relevant policy should therefore always be considered by those working on sustainable transformations with a recognition that power may (attempt to) drive change in various directions.

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Fourthly, this thesis adds evidence to the literature on '*regime resistance*' in transitions studies (Geels, 2014). Policy episode 10 described efforts by incumbents who face risk from the electrification of heat to attempt to influence policy in a way that protects their interests. While in Dutch discussions around energy transformations it was seen to be incumbents who dominated discussions in general (Kemp *et al.*, 2007), this research has shown engagement and impact by actors across scales and market positions in agreement with Rotmans and Kemp (2008). Their research suggests that '*power is distributed over various actors, with different beliefs, interests and resources*' (p1007). While this spread of power in the UK across scales of actor suggests that for the time period considered by this research, small actors have had power over policy change, more recent research has suggested that large incumbent actors have dominated the UK heat policy space as the threats posed by decarbonisation to incumbents have become more apparent (Lowes *et al.*, 2018b). It may therefore be that the power of actors varies over time and is dependent on the relevant policy issue and how it may affect relevant interests.

It is also clear that the incumbents have the capacity to attempt to influence in ways that smaller actors do not, with resources available to pay for influencing activities and political engagement. Because larger actors will always have greater resources than smaller actors, one political power element of Unruh's (2000) 'Carbon Lock-In' is that regime actors structurally have greater capacity to have power than smaller niche actors, this could potentially lead to lock-in effects.

The most valuable aspect of this research for scholars interested in the MLP is its consideration and use of a specific approach to power alongside the MLP model and the development of a specific model for visualising political power across socio-technical systems. In much of the research on power and transitions, a clear approach to power and clear methodology is absent. This thesis is explicit about the approach to power taken (the four faces plus ideas of structural/agent based power and ideas of power over/power to) and uses a methodology (the EAR instrument) which is clearly repeatable. The four faces of power approach, in its all-encompassing yet relatively clear nature, represents a valuable tool for those interested in power and transitions. However, it should

be noted that the fourth face or post structural approach to power is, as has been described elsewhere, particularly difficult to apply. Indeed, throughout the results sections, it has been possible to recognise the first face of power (power over another), the second face (agenda setting) and the third face (preference shaping). However for those interested in the fourth face or post-structural elements of power, a more specific focus and methodology may be required. This could potentially be based around more discursive or ideational approaches to considering policy change where language and ideas are a much more central focus of analysis (e.g. (Kendall and Wickham, 1999; Carstensen and Schmidt, 2016).

Chapter 6 introduced the transformation policy power framework which looked to combine insights from theories of power and policy change with the multi-level perspective model. Drawing on the results of this research allows this model to be updated, as shown in Figure 12-1. This updated model contains only two minimal changes. Firstly, 'the existing heat regime' isn't purely formed of gas and so the word gas has been removed from the title. Secondly, the second face of power arrow has been modified to show that niche actors can utilise the second face of power and successfully raise issues onto the agenda.

As well as providing a visual representation of the outputs of this research, this model will be of value to others looking to investigate power, policy and transformations and could be applied and tested for other socio-technical systems or for other geographies.

It should however be noted that the focus on the power of actors in this research means that power at the landscape level has not been investigated in any detail. Further research considering the landscape impact on policy development, including some of the fourth face elements of power described previously, could strengthen the framework further.
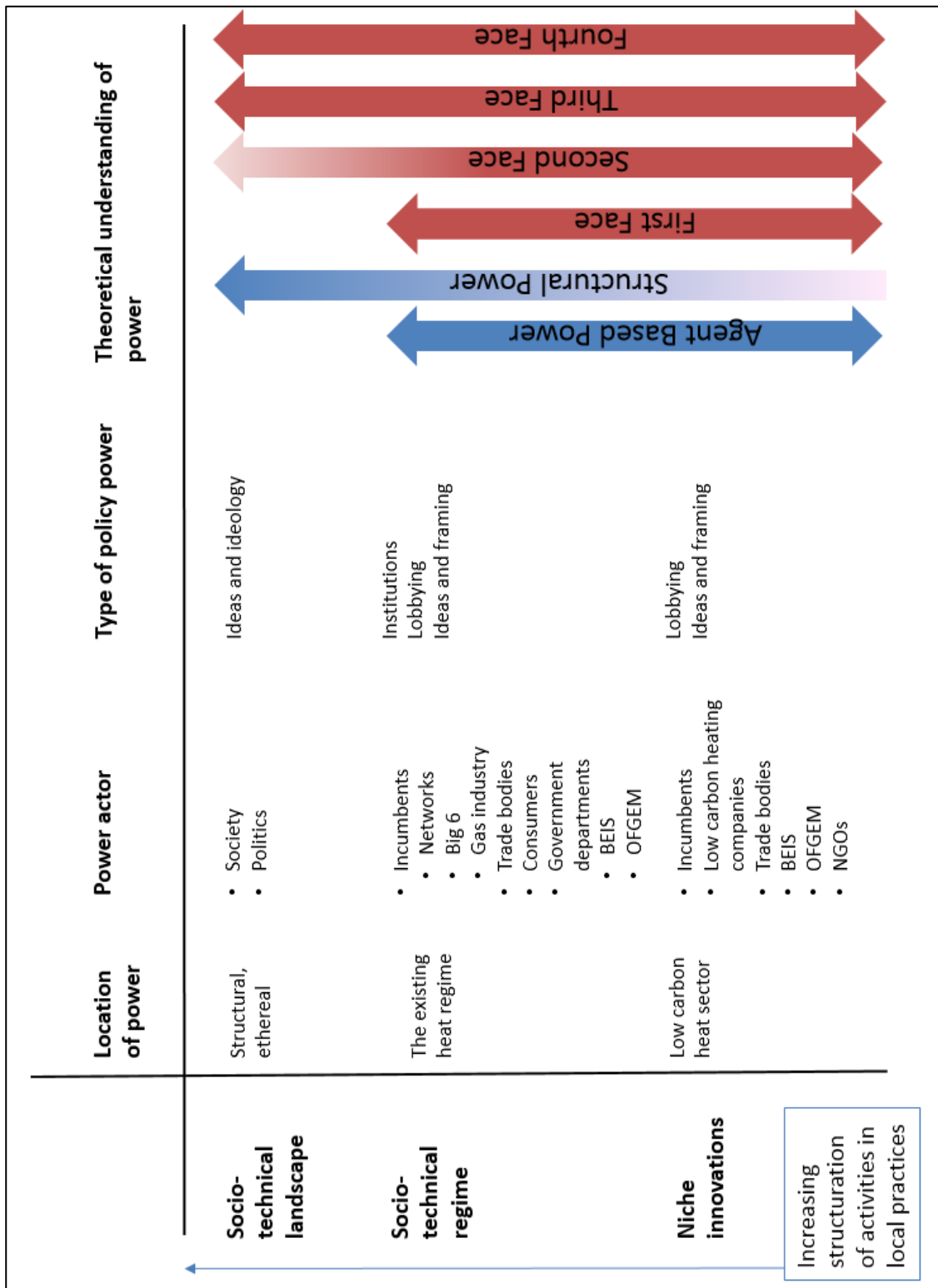
Figure content:

Theoretical understanding of power	Type of policy power	Power actor	Location of power	
Fourth Face / Third Face / Second Face (First Face)	Ideas and ideology	• Society • Politics	Structural, ethereal	**Socio-technical landscape**
Structural Power / Agent Based Power	Institutions Lobbying Ideas and framing	• Incumbents • Networks • Big 6 • Gas industry • Trade bodies • Consumers • Government departments • BEIS • OFGEM	The existing heat regime	**Socio-technical regime**
	Lobbying Ideas and framing	• Incumbents • Low carbon heating companies • Trade bodies • BEIS • OFGEM • NGOs	Low carbon heat sector	**Niche innovations**

Increasing structuration of activities in local practices

Figure 12-1. The transformation policy power framework updated from Figure 6-1 p130 chapter 6

12.2 GENERAL FINDINGS, CONTRIBUTION AND FURTHER RESEARCH

Power has been shown to have impacted the policy associated with the UK's transformation to low carbon heating. As highlighted in this study, actors have been able to affect policy in a way which suits them, speeding up the

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introduction of the RHI policy, increasing tariffs for certain technologies (bio-energy in this study) and affecting the Government's long term heat strategy (apparently increasing the future role for gas in heating). The specific changes to the RHI will have had a material effect on the UK's heat system affecting the deployment of certain heat technologies. It is however unclear what impact the gas industry lobbying will have on the UK's actual heat future.

The power of actors is not something that can be obviously managed and interests will be an important part of any transformation. However, the main concern highlighted by this analysis is that if certain vested interests are able to shape the transformation around their own interests, the resulting system or transformation may be sub-optimal or perhaps worse, change will either not happen or will happen too slowly. The power of actors could therefore result in policy targets (such as those for decarbonisation) being missed, have energy security implications and result in poor consumer outcomes such as high cost technologies. A key issue for policy makers therefore is around the ability of existing interests to influence policy and cause sub-optimal outcomes.

As well as contributing to debates associated with power and the transformations of large systems, this thesis also fits into two other areas of study, (i) power and policy change and (ii) policies for heat decarbonisation.

As explained in the literature review, systematic analyses specifically investigating power in UK policymaking are limited in number and much investigation into power and lobbying has been carried out by journalists and private organisations. While some research exists which considers certain elements of power such as the role of institutions or ideas, this thesis provides a recent and applied example of power in UK policy making which focuses on the power of actors.

In the most general sense, this research has shown that interested actors are clearly engaging in this particular element of UK policy and do attempt to influence and so this study builds on the limited and mostly descriptive research into lobbying in the UK which was considered in section 5.3.2. Where this research adds value and novelty is in considering how specific (UK) policy changes have actually been impacted by actors. Previous research has primarily provided accounts of attempts to influence rather than considering

impact. This research also develops what appears to be an extremely limited academic literature associated with UK energy lobbying.

This research has also highlighted the role of framing in approaches to influence, providing a detailed view on how actors frame their policy requests. However, this research did not recognise the frequent use of framing around energy security in the UK which has been recognised previously (Kuzemko, 2013d), although it should be noted that the Dutch policy context made the energy security frame particularly powerful. It was recognised in the analysis within this thesis that framing can be an extremely fluid approach and approaches to framing change over time depending on the perceived views of the person who is being lobbied.

This thesis has also employed a theoretical approach to power, the four faces approach, which does not appear to have been used in a specific policy context before. The approach has been found to be useful and the first three faces of power have been identified in various elements of the research. Table 6 in the conclusions of chapter 8 details the faces of power identified in each of the policy episodes and also details other elements of power including its structural or agent-based nature. As explained in the previous section however, the fourth face, post-structural or Foucauldian approaches to power, do not emerge from the research as clearly as the other three faces. This may reflect known issues with the complexity of analysing the fourth face of power (Arts and Tatenhove, 2005) but can also be attributed to the fact that the research method was considering the active approaches of actors to have power over policy changes.

Overall, while the faces of power approach does have value in its ability to cover and arrange what appear to be the key elements of power, for researchers investigating actor based or more active power, Lukes' 'radical' three faces of power (power over, agenda setting and preference shaping) may be radical enough (Lukes, 2005). Only those with an interest in the more post-structural (and potentially passive) understandings of power should consider the fourth face and should employ appropriate methodologies. A fuller understanding of the power associated with socio-technical systems could be attempted by combining methodological approaches to consider actor based power and post-structural power. However, the required time needed for such a

mixed-methods study could limit the scope of this sort of research. This issue is slightly expanded in the following section on methodological issues (12.3).

Considering whether power is more agent based or structural has added greater depth to this analysis and in some examples has highlighted the importance of the institutional context of power and the power of institutions themselves to control or limit power. Much of the power observed in the research has resulted from the situational (institutional) position of actors such as civil servants or ministers who as a result of their position are able to do things and exercise power which others simply cannot. Where small or non-institutional actors or agents appear to have had power, this seems to have resulted from working together in unison creating intransitive 'power to' rather than the more dominating 'power over'. This highlights the potential importance of 'intransitive power' for actors working collaboratively to achieve policy change.

A key question is whether any general comments can be made about power in UK heat policy, based on the results from this research. This analysis suggests that it is possible to make some general comments on power issues:

- Actors of varying scales have been involved in UK heat policy and scale of actor does not appear to be a predictor of policy success. This finding is in slight contrast with Geels (2014) who suggests that UK energy policy makers are most likely to deal with '*incumbents and technical experts*' (p34).

- The approaches used by actors do appear to vary across scales, with larger actors in general appearing to take a more balanced and constructive approach to engaging with policy makers, and some small actors appearing to take particularly aggressive approaches. It appears that both approaches are seen as valid by policy makers but it is not possible to make any conclusions about whether either approach is more influential. This difference between 'brash' and 'soft spoken' lobbying styles has indeed been recognised elsewhere but has been seen to be linked to where lobbing is taking place rather than being linked to the type of actor (Woll, 2012).

- While certain trade associations appear to be particularly trusted by policy makers, these organisations do not appear to have had any particular policy successes.

- It does appear from this analysis that tactical approaches to lobbying can be most successful, in particular working together and forming coalitions and jointly lobbying both politicians and the administration can increase policy success.

- Legitimacy and trust can also be particularly important attributes for those looking to influence. The role of legitimacy in maintaining political support has been highlighted previously (Smink, 2015).

However, what this research also highlights is that the power of actors is extremely contextual. For example, some actors (such as senior civil servants or ministers) have power as a result of their institutional position. Some frames are important at particular times and not others. The timing of influencing may also be particularly important; the Dutch earthquakes appear to have empowered the low carbon heat industry in the Netherlands (potentially providing what has been referred to as 'a window of opportunity for sustainability transitions' (Geels, 2013, p93).

While this research focused on a relatively small element of the UK's energy policy, even focusing on this small area has shown significant efforts to attempt to influence policy and shown that lobbyists can have an impact. Because of the potential impact that lobbying may be able to have across UK policy and the current lack of research, more investigations into lobbying in the UK would be of value. This thesis has specifically highlighted that further research to investigate the role and impact of actors influencing the consultation process as well as more detailed consideration of discursive or 'ideational' elements of power would provide an even more detailed picture of power in UK heat policy.

12.3 METHODOLOGICAL AND THEORETICAL ISSUES ASSOCIATED WITH THIS RESEARCH AND PERSONAL REFLECTIONS

As recognised in the theoretical chapters of this thesis, the concept of power is not just a difficult issue to tie down, but it is also difficult to measure and there is no set or standard approach. The approach that I have taken in this thesis is the closest to an 'applied' approach as appeared possible, with a clear and

repeatable methodology. The methodology has been particularly successful because it made no presuppositions about power. Instead, issues of power emerged naturally from interviews through both interview data itself (through coding), but also from suggestions from interviewees of other interviewees and issues to consider.

The use of the EAR approach in a UK setting is novel and the approach of attempting to apply the faces of power to a specific policy issue is also unique.

Overall, the use of interviews has provided a great deal of valuable data which has led to interesting results and it is not obvious that there would have been a better methodology for data collection for the study. Whilst providing useful results, fifty two interviews with transcription and coding took up a significant proportion of the project's time and more interviews would not have been possible within the project timescales.

However, while the methodological approach has been a success, a key issue which emerged repeatedly from this research was the scale of analysis. The explorative nature of this research meant that rather than picking a particular issue and driving down in detail into this, interviews were used to highlight where power struggles had taken place across heat policy. As a result, this thesis is relatively broad and considers a large number of policy changes related to heat.

Focussing only on a smaller element of heat policy such as the development of the heat strategy could have provided a more detailed specific example of power. More time to focus on fewer issues could allow for more interviews on specific issues (potentially through a second round of interviews) and further grey literature analysis alongside the potential use of 'freedom of information' requests. However, focussing on a smaller scale issue would have reduced the breadth of the analysis and would have meant that making generalisations would have been even more difficult. There is no set scale to consider power and it is clearly possible to investigate power at varying scales. Researchers therefore need to make a judgement when carrying out research into power to consider both what scale of enquiry will produce the most meaningful outputs and what is possible in the available time.

The four faces of power approach is a relatively straightforward concept. However, as identified several times in this chapter, the fourth face of power has not clearly emerged from the findings. If post-structural understandings of power are to be considered, the fourth face of power would be expected to be present across all individuals and across all of society. This therefore suggests that the positivist and applied EAR methodology is not appropriate for considering the fourth face and for those interested in active approaches to power where actors drive change, post-structural approaches to power may be of only limited value. This echoes the view of Arts and Tatenhove (2005) who suggested that the post-structural approach to power can deny a role for human agency which is central to policy analysis.

While post-structural or Foucauldian approaches to power are notoriously difficult and it is questionable whether Foucault even set out to measure or investigate power specifically, there are methods to consider post-structural approaches to power which take into account ideas (Carstensen and Schmidt, 2016), discourses (Jorgensen and Phillips, 2002) and specifically ideas of Foucault (Kendall and Wickham, 1999). Further mixed methods studies which combine the use of the EAR instrument alongside post-structural approaches could potentially provide results which consider all four faces of power in detail and in doing so provide a fuller and non-actor centric approach to power. As explained in the previous section, combining power methods may also have value for those interested in how power is present across the entirety of socio-technical systems.

Post-structural approaches may also be able to shine some light on the wider power of ideas to cause policy change. This research has highlighted how energy modelling, reports and scenarios are used by actors to have power. The study has also highlighted ideas of 'legitimacy' and 'workability' are seen to affect policy change. Further, more discursive research could investigate the power of these sorts of issues in more detail and investigate the policy impacts of ideas on transformation related policy.

The EAR instrument has proved a valuable tool for this research which is both straightforward to apply and repeatable. The use of the EAR approach has also repeatedly shown the limits of preference attainment methods to consider lobbying and has highlighted several examples where the preference attainment

approach would have delivered what appear to be false results under more detailed analysis. This suggests that preference attainment methods should be avoided. In building on Arts and Verschuren (1999), the use of the EAR instrument in this thesis has been modified to include the use of email communications as well as interviews; this change has been extremely valuable for gaining very specific information for the purposes of triangulation. The use of the EAR instrument has also shown that examples of lobbying may not primarily be raised by lobbyists (egos) during interviews as the method proposes but may also be raised by policy makers (alters).

It is however clear that the EAR approach is not infallible. The reliance on policy makers' views to triangulate the views of lobbyists is limited by the fact that a policy maker will often not want to explain that they have been successfully lobbied and if this is the case, thorough triangulation will never be possible. Conversely, lobbyists may not want to describe their own lobbying behaviours for reputational reasons. For these reasons, it may be valuable to engage with policy makers or lobbyists who no longer work on the policy in question or no longer work for the civil service or relevant company in order to glean more honest answers. The EAR approach also relies on having access to relevant lobbyists, the relevant policy maker (who may have moved roles) and grey literature to enable full triangulation, clearly this is not always possible and is an extremely time consuming approach. The issue around access to data sources was highlighted by the Dutch case study, which required complex logistics to identify relevant interviewees and to locate and translate documents. As well as limiting the potential for triangulation, if certain interviewees or data sources are not available, then it is possible that certain power issues will simply not be spotted. This issue once again highlights the importance of selecting an appropriately sized study and having good access to data and interviewees.

Investigating power can also be personally challenging for several reasons. This is primarily because practices around lobbying are often carried out away from public view and are generally viewed negatively. As a result, considering power and influence requires a level of investigation into the behaviour of individuals and companies which may not be appreciated, and which may be challenged. It should however be noted that I was often surprised by the openness of some interviewees and I actually anonymised some comments which were allowed to

be attributable. Conversely, during some interviews it often felt as if interviewees were attempting to lobby me and shape my own views on the topics under investigation. This issue highlights the importance of triangulation when investigating power issues.

One key personal concern was that the research and its focus on power and influencing could negatively affect my relationship with actors in the UK heat sector and therefore affect the potential for future research or even jobs. This research was therefore carried out in as sensitive a way as possible. In particular, the historic focus of the analysis and the use of anonymisation and hiding company names meant that potential for reputational damage for individuals and companies as a result of this research is reduced. These personal issues should be considered by researchers in advance of making decisions around whether or not to investigate power.

12.4 IMPLICATIONS FOR POLICY MAKERS

As this thesis focuses on policy and attempts to be an applied piece of research, this final section provides some recommendations for policy makers which have been synthesised from the findings of this thesis. These are split into two sections, the first which considers general recommendations for policy with regards to power and the second which contains recommendations for policy makers working on UK heat policy.

12.4.1   General policy recommendations

1. A good understanding of power, interests and policy change would benefit all individuals involved in the development of policy. Currently there appears to be no specific training on power for UK civil servants, although there is a basic guide to 'contact with lobbyists' which primarily links back to the civil service code (Cabinet Office, 2010).

2. Knowledge and evidence and its representation should always be treated carefully, with consideration always given to the sources of that evidence. Independent, and ideally peer reviewed, research should always be used.

3. Policy makers should be able to recognise situations of regulatory capture or information asymmetries and provide resource to remove or reduce these asymmetries by carrying out independent research.

4. Investigating lobbying is hard but it is extremely important. Government should make efforts to significantly increase transparency around lobbying by expanding the register of lobbyists to cover all lobbyists and publishing details of all meetings of civil servants, ministers and parliamentarians with those looking to influence.

5. The importance of objectivity in the civil service should be maintained and continuously reinforced.

12.4.2 Recommendations for UK heat policy makers in addition to the above

1. Efforts should be made to increase the speed at which changes to the RHI can be made. Removing the need for parliamentary involvement by modifying legislation to authorise ministers to make scheme changes could help.

2. Recognising the resource limits of small firms, policy makers should actively encourage engagement with smaller companies directly involved in low carbon heating and not rely on trade associations or large integrated firms.

3. A central, independently operated and publicly available database of technology costs and performance should be developed and updated frequently. This should be used for all energy analysis to maintain a standardised dataset for heat (and energy) analysis. This happens in Denmark and a study of good practice and usefulness there might inform an equivalent development in the UK (Danish Energy Agency, 2018). This could minimise some of the issues associated with power and evidence/knowledge.

4. Building on existing analysis, the UK Government should further investigate international examples of where low carbon heat has been deployed at scale to gain evidence on future heat technologies.

5. UK heat policy makers should work closely with the Dutch Government who face an almost identical heat challenge as that in the UK. Particular notice should be taken of the strong energy relationship between national and local governments in the Netherlands and of the municipal nature of network ownership.

6. Policy makers should be aware that incumbents have a history of attempting to block or limit change and protect markets. The policy design process should ensure that incumbent interests do not negatively influence policy outcomes.

The UK (and international challenge) for heat decarbonisation is clearly significant and considering the power of actors makes the transformation appear even more complex. I hope that as one of the early interventions in the UK's debate around heat decarbonisation policy, this research and the associated policy recommendations have some value for policy makers who are dealing with the heat challenge. I also hope that I and others are able to build on this research and further support policy makers with heat decarbonisation, particularly in the context of an increasingly politicised heat debate in the UK.

13 ANNEX 1 - ASSOCIATED RESEARCH, OUTPUTS, IMPACT AND THE EXPERIENCE OF THE RESEARCHER

13.1 THE HEAT, INCUMBENCY AND TRANSFORMATIONS PROJECT

The research which contributed to this thesis originally started in 2014 and interviews were carried out in 2015 but following interviews, the write up of the thesis was delayed. The delay was a result of the UK Energy Research Centre (UKERC) Heat, Incumbency and Transformations (HIT) project for which Bridget Woodman, Catherine Mitchell and I received funding and which took place between June 2016 and June 2018. I was working almost full time on the project leaving little time to complete my thesis.

Still focusing on heat, the HIT project took a very different focus to this PhD, considering a different time horizon (2015-2018) and also focusing specifically on ideas of 'incumbency[42]'. While the research highlighted significant 'power' issues associated with attempts to influence Government policy, the project also considered wider issues of innovation and investment and what these meant for a move to a more sustainable heating system.

Overall, the research highlighted numerous attempts by incumbents (primarily gas network operators and the gas boiler manufacturers) to maintain the existing gas-based system through the promotion of low carbon gases which are suggested to be a like for like replacement for natural gas but which are very uncertain approaches. There are significant known issues with many of the approaches proposed by the incumbents suggesting that incumbents may have

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[42] Incumbency can be considered as the impact of incumbents. Lowes et al., (2017, p32) suggested that incumbency can be defined '…in the context of sustainable transformations as the presence of existing actors within a specific socio-technical system. An incumbent will be currently active in the socio-technical system or a part thereof and therefore likely to be or have been involved in unsustainable practices. Incumbents have the economic, social or technological capacity to influence system change.' In the UK's heat system the incumbents include the businesses currently operating in the system.

been promoting ideas based purely on their own interests rather than offering an optimum solution for heat decarbonisation (Lowes *et al.*, 2018b).

13.2 OUTPUTS AND IMPACT

There are a number of publications directly associated with this PhD:

- A key output associated with this thesis is a paper which was presented to the 2016 British Institute of Energy Economics conference in Oxford. This paper specifically considered the power of actors to cause policy change and links closely to chapter 8 in this thesis (Lowes, 2016).
- This paper has since been redrafted and following peer review has been published in 'Energy Policy' (Lowes et al., 2019).
- Separate to this paper, I also contributed to an article which has now been published in Renewable Energy which describes the design of the renewable heat support policies in the UK (Connor *et al.*, 2015).

Since starting my PhD I have also been involved in a number of impact activities. These include:

- Reviewing Parliamentary Offices of Science and Technology Postnotes investigating the future of the natural gas network and the carbon intensity of heat generation
- Presenting early findings from my PhD to civil servants in BEIS
- Making a number of appearances on local and national media including taking part in a Radio 4 debate on bio-energy (and separately talking to Anne Diamond about British Gas price increases)
- Advising the National Audit Office on its review into the Renewable Heat Incentive Policy and subsequently being invited to give evidence to the Parliamentary Accounts Committee which was referenced in their final report
- Reviewing and contributing to various reports on heat decarbonisation including reports by think tank Carbon Connect and also Friends of the Earth.

13.3 ABOUT THE RESEARCHER

Prior to commencing this PhD and following an MSc in Energy Policy and Sustainability in 2010, I worked for a UK gas distribution network (SGN) on energy policy issues associated with the future of the UK gas distribution network and new sources of gas, such as biogas and shale gas. Throughout the early days of my PhD, I continued some work for this gas network owner focussing on issues to do with renewable gas policy. This work came to an end in 2016 however since then I have been sitting on the gas network's Stakeholder Advisory Committee, advising the company on its stakeholder engagement to do with issues around the long term future of the gas grid. My experience at SGN meant that before starting my PhD I had some knowledge of the subject area and a small network of contacts in the relevant area.

There was the potential for existing knowledge and experience to affect the research process and eventual outcomes. In order to minimise this risk and increase the rigour of this thesis, the research has been designed with this in mind. Specifically, the research has taken an applied and realist approach to power which considers purposive and observable attempts to affect heat policy rather than less observable and more subtle types of power (read chapter 4 for more detail on this). This approach of focusing on observable power was designed so that rather than taking any pre-judgements on what power may look like in the context of heat policy, ideas of power and its impacts on heat policy emerged purely from the explorative research (i.e. interviews). This approach reduced the likelihood of research being skewed towards my own potential interests which could be possible with less active approaches to power such as more reflective discursive or language based approaches. That is not to say these other elements of power are not important, but is to highlight the more applied understanding of and approach to power within this work.

14 ANNEX 2 – LIST OF INTERVIEWEES

Interviews are numbered and referenced accordingly throughout the thesis.

1. Academic with expertise in renewable heat policy 2015, 11th March 2015
2. Heat expert with experience in large energy supplier and in UK civil service, 9th March 2015
3. Civil servant from DECC/BEIS, 25th March 2015
4. Chief executive of trade association interested in heat, 25th March 2015
5. Heat expert with experience working in regulator and academia, 29th April 2015
6. Heat expert from on UK Government Climate Change advisor, 29th April 2015
7. Ex chief executive of trade association interested in renewable heat, 30th April 2015
8. Representatives from trade association representing heating and hot water appliance sector, 1st May 2015
9. Representative from trade association which represents UK energy networks, 1st May 2015
10. Chief executive of heat pump manufacturer, 5th May 2015
11. Policy manager at trade association interested in renewable heat, 19th May 2015
12. Policy manager from trade association which represents energy suppliers, 20th May 2015
13. Policy manager from trade association representing biogas sector, 20th May 2015
14. Policy manager from trade association interested in renewable heat, 20th May 2015
15. Policy manager from large energy supplier, 5th June 2015
16. Fully anonymous, 16th June 2015
17. Head of external engagement for large appliance manufacturer, 17th June 2015
18. Policy manager for large energy supplier, 22nd June 2015
19. Policy manager for trade association interested in low carbon heat, 23rd June 2015

20. Chief executive of trade association interested in low carbon heat, 10th July 2015

21. Owner of biomass supply company, 14th July 2015

22. Strategy manager at gas network company, 17th July 2015

23. Civil servant from DECC working on low carbon heat market development, 24th July 2015

24. Senior civil servant working on heat at DECC, 6th August 2015

25. Director of consultancy interested in low carbon heating, 7th August 2015

26. Civil servant at DECC, 11th August 2015

27. Civil servant at DECC, 12th August 2015

28. Fully anonymous, 12th August 2015

29. Civil servant at DECC, 12th August 2015

30. Employee at consumer protection organisation, 13th August 2015

31. Policy manager at trade body interested in heat pumps, 12th October 2015

32. Policy manager at trade body interested in heat pumps, 13th October 2015

33. Employee at heat installation firm, 12th October 2015

34. Policy manager at UK energy regulator, 28th October 2015

35. Representative from heat installation firm, 1st November 2015

36. Previous DECC 'Chief Scientist', 5th November 2015

37. Owner of renewable heat appliance manufacturer, 12th November 2015

38. Policy manager from trade association interested in off gas grid heating, 9th December 2015

39. Policy manager from NGO interested in clean energy, 14th December 2015

40. Chief scientist from NGO interested in clean energy, 17th December 2015

41. Representatives from Government of Rotterdam, 9th September 2015

42. Representative from Dutch energy network company, 8th September 2015

43. Civil servants from Dutch Ministry of Economic Affairs, 9th September 2015

44. Representative from Dutch energy network company, 10th September 2015

45. Representative from large Dutch energy supply company, 11th September 2015
46. Civil servant from Dutch Ministry of Economic Affairs, 12th October 2015
47. Ex-employee of organisation interested in social housing, 15th October 2015
48. Dutch energy industry trade association, 5th November 2015
49. Representative from trade association interested in low carbon heat, 6th November 2015
50. Representative from Dutch low carbon heat network, 8th December 2015
51. Representative from Dutch research organisation, 9th December 2015
52. Ex-employee of NGO interested in green energy, 8th March 2016

15 ANNEX 3 – INTERVIEW QUESTIONS

15.1 QUESTIONS POSED TO EGOS (THOSE ATTEMPTING TO INFLUENCE)

1. What is your interest or experience in heat policy?
2. Have you had any success in influencing policy around heat?
   a. How do you know you have been successful?
3. Have you had any failures and if so why?
4. What approaches did you find particularly useful for influencing policy?
5. Are there any other companies or organisations that you believe have been particularly successful in influencing heat policy?
   a. How do you know they have been successful?
6. Do you feel that the existing heat providers have a particularly great influence over policy?
   a. How and why?
7. When you try and get a policy change do you frame arguments in a particular way to try and make the change seem necessary to policy makers?
8. Have you got any experience of other companies or organisations framing arguments in particular ways?
9. Do you feel that the Government organisations involved in heat policy take a purely objective approach when formulating policy?
   a. If not, what else is driving the development of heat policy?
10. Do you have any experience of companies and organisations trying to shape perceptions of themselves or their company or product?
    a. For example the shaping of consumer preferences?
    b. Or the shaping of political preferences?

15.2 QUESTIONS POSED TO ALTERS ALTER (THOSE WHO EGOS ARE ATTEMPTING TO INFLUENCE)

1. What is your experience in heat policy?
2. Do you have any experience of companies and organisations trying to influence heat policy?

3. Do incumbent heat organisations and companies have significant influence over heat policy?
    a. Talk about areas where they believe they have been successful
4. Are renewable heat companies particularly successful?
    a. Talk about where niche companies believe they have been successful
    b. Has their influence increased because of policies which support them?
5. Do you ever see organisations use particular frames or ideas to argue for their particular preferred approach to policy?
6. Do you feel that the Government organisations involved in heat policy take a purely objective approach when formulating policy?
    a. If not, what other than evidence is driving the development of heat policy?
7. Do you have any experience of companies and organisations trying to shape perceptions of themselves or their company or product?
    a. For example the shaping of consumer preferences?
    b. Or the shaping of political preferences?

16 ANNEX 4 – TARIFFS FOR THE RHI INCLUDED IN THE ORIGINAL 2010 DECC CONSULTATION DOCUMENT (DECC, 2010A, P46-47)

Small installations (1)

Technology	Scale	Proposed tariff (pence/ kWh) (2)	Deemed or metered (3)	Tariff lifetime (years)
Solid biomass	Up to 45 kW	9	Deemed	15
Bioliquids (7)	Up to 45 kW	6.5	Deemed	15
Biogas on-site combustion (5)	Up to 45 kW	5.5	Deemed	10
Ground source heat pumps (8) (9)	Up to 45 kW	7	Deemed	23
Air source heat pumps (9)	Up to 45 kW	7.5	Deemed	18
Solar thermal	Up to 20 kW	18	Deemed	20

Medium installations

Technology	Scale	Proposed tariff (pence/kWh) (2)	Deemed or metered (3)	Tariff lifetime (years)
Solid biomass	45-500 kW	6.5	Deemed	15
		2 (fuel tariff)	Optional: for metered kWh above deemed number of kWh	15
Biogas on-site combustion (5)	45-200 kW	5.5	Deemed	10
Ground source heat pumps (8)(9)	45-350 kW	5.5	Deemed	20
Air source heat pumps (6)(9)	45-350 kW	2	Deemed	20
Solar thermal (6)	20-100 kW	17	Deemed	20

Large installations

Technology	Scale	Proposed tariff (pence/kWh) (2)	Deemed or metered	Tariff lifetime (years)
Solid biomass (4)	500 kW and above	1.6 – 2.5	Metered	15
Ground source heat pumps (8)(9)	350 kW and above	1.5	Metered	20

Biomethane injection

Technology	Scale	Proposed tariff (pence/kWh) (2)	Deemed or metered	Tariff lifetime (years)
Biomethane injection	All scales	4	Metered	15

17 ANNEX 5 – UNDERSTANDING THE CONTEXT BEHIND THE 'RENEWABLES VERSUS CARBON FRAME' (THE SUBJECT OF SECTION 10.2.2)

Renewable energy is according to the International Energy Agency: 'Energy derived from natural processes (e.g. sunlight and wind) that are replenished at a faster rate than they are consumed. Solar, wind, geothermal, hydro, and some forms of biomass are common sources of renewable energy.' (IEA, 2016). The EU, under the renewable energy directive is more specific in defining renewable energy as specific technologies and sources:

'(a) 'energy from renewable sources' means energy from renewable non-fossil sources, namely wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases;

(b) 'aerothermal energy' means energy stored in the form of heat in the ambient air;

(c) 'geothermal energy' means energy stored in the form of heat beneath the surface of solid earth;

(d) 'hydrothermal energy' means energy stored in the form of heat in surface water;

(e) 'biomass' means the biodegradable fraction of products, waste and residues from biological origin from agriculture (including vegetal and animal substances), forestry and related industries including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste; ' (European Union, 2009)

While the definition of renewable energy is generally un-contested in the literature and within my data, defining 'low-carbon' is significantly more difficult because it is a relative measure; just because something is lower-carbon than

something else does not necessarily make it low carbon. For example, natural gas being used for heat in a boiler is lower carbon than oil in a boiler (POST, 2016), however few would view gas as 'low-carbon' particularly in the context of a decarbonised or zero carbon heat system which is seen as a requirement by DECC in 2050 under the UK's carbon constraints (DECC, 2013k).

As well as the semantic nature of the construction 'low carbon', specific heat technologies can have widely varying carbon intensities due to operational factors such as efficiencies and the application, for example an efficient gas boiler would have lower carbon emissions than a less efficient gas boiler and a biomass boiler's carbon intensity can vary significantly depending on the source of biomass among other factors (POST, 2016).

With electric heating technologies such as resistive heating and ground source or air source heat pumps, the carbon intensity of the heat will vary depending on the installation and operation of the heater; it will also vary depending on the carbon intensity of the electricity running it (POST, 2016). This means that as the electricity sector reduces its carbon intensity as is expected (DECC, 2013k), over time, electric forms of heat become lower carbon. Carbon footprints ranges for a number of space and water heating technologies are shown in Figure 17-1, which clearly shows the variation in carbon heating between different heating technologies, within specific technology groups and also the impact that the grid intensity of electricity can have.

Technology	Footprint range (gCO_2eqkWh)	Number of estimates
Oil boilers	310-550	3
Gas boilers	210-380	6
Gas micro-CHP	220-300 [22]	4
GAHP	150-200 [40]	4
Bio-sourced gases	20-100 [41]	2
Biomass boilers	5-200 (most below 100) [42]	9
Geothermal	10	1
Solar thermal	10-35	6

Technology	Electricity footprint estimate	Footprint range (gCO_2eqkWh)	Number of estimates
Electric heaters	Current (370)	~370	Personal Communication [59]
	Reduced (250)	~250	
	Low (100)	~100	
Ground source heat pumps	Current (370)	70-190	15
	Reduced (250)	50-125	
	Low (100)	20-50	
Air source heat pumps	Current (370)	90-250	11
	Reduced (250)	60-170	
	Low (100)	30-70	

Figure 17-1. Carbon intensity estimates for non-electric space and water heating (left) and electric heating under three electricity supply scenarios (right) (POST, 2016)

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